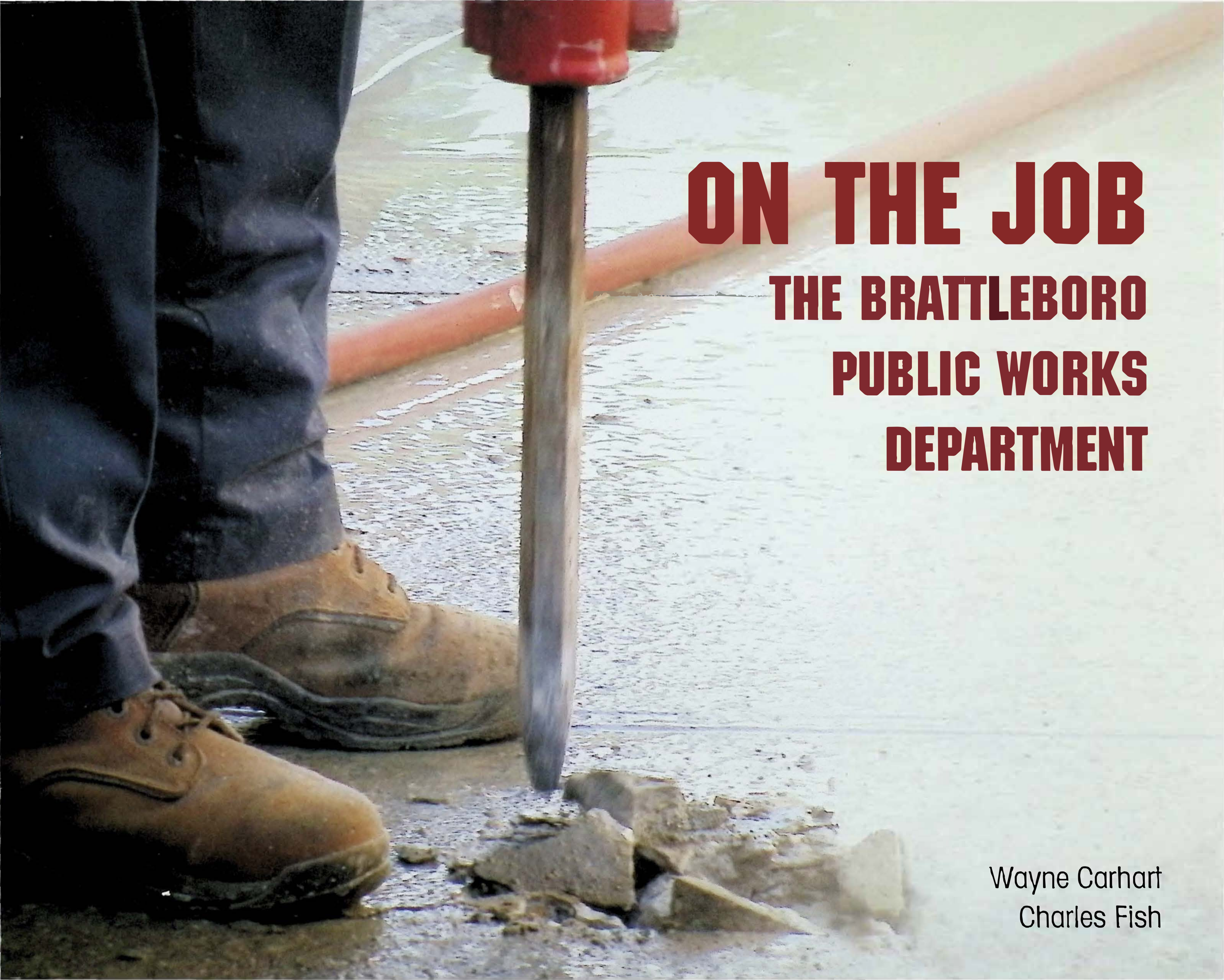

ON THE JOB

THE BRATTLEBORO PUBLIC WORKS DEPARTMENT

Wayne Carhart
Charles Fish

U.S. $15.00

One of the quiet triumphs of a municipality such as Brattleboro, Vermont, unlike many parts of the world, is the ability to provide clean water for its citizens and to dispose of waste without contaminating its streams. So long has this been true and so dependably and efficiently is the job done that most of us enjoy the benefit without thinking twice about it.

And much the same can be said of the other essential services delivered by the Brattleboro Public Works Department. True, a heavy snowstorm may blanket the roads and potholes may jar us in the spring, but we usually go about our business unimpeded.

How all this happens is the story of *On the Job*. Richly documented in photographs and texts, the book traces the water from the Sunset Lake reservoir to the wastewater treatment plant, follows the snowplows clearing the streets, chronicles the life of offending potholes from first breakup to patching and repaving, observes backhoes scooping out a ditch and peers in while men lay pipe, and visits the garage where expert mechanics keep massive machines in running order. And of course the tour includes the administration with its busy communication and planning centers where decisions are made that direct the complex operations of the department.

The photographs show the skill, vigor, and strength of the workers and the functional elegance of the tools and machines. *On the Job* will please the eye and leave the reader with a greater appreciation of how the necessities of civilized modern life are provided.

ON THE JOB

THE BRATTLEBORO PUBLIC WORKS DEPARTMENT

Wayne Carhart *text*
Charles Fish *photography*

PUBLISHED BY THE BRATTLEBORO AREA CHAMBER OF COMMERCE
BRATTLEBORO, VERMONT

On the Job: The Brattleboro Public Works Department
Wayne Carhart and Charles Fish

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CONTENTS

Acknowledgments v

Introduction vii

Water Supply 1

Wastewater Treatment 9

Road Signs 16

Resurfacing and Rebuilding Roads 22

Snow Removal 28

Potholes 34

Retaining Walls 40

Maintenance 44

Tools of the Trade 49

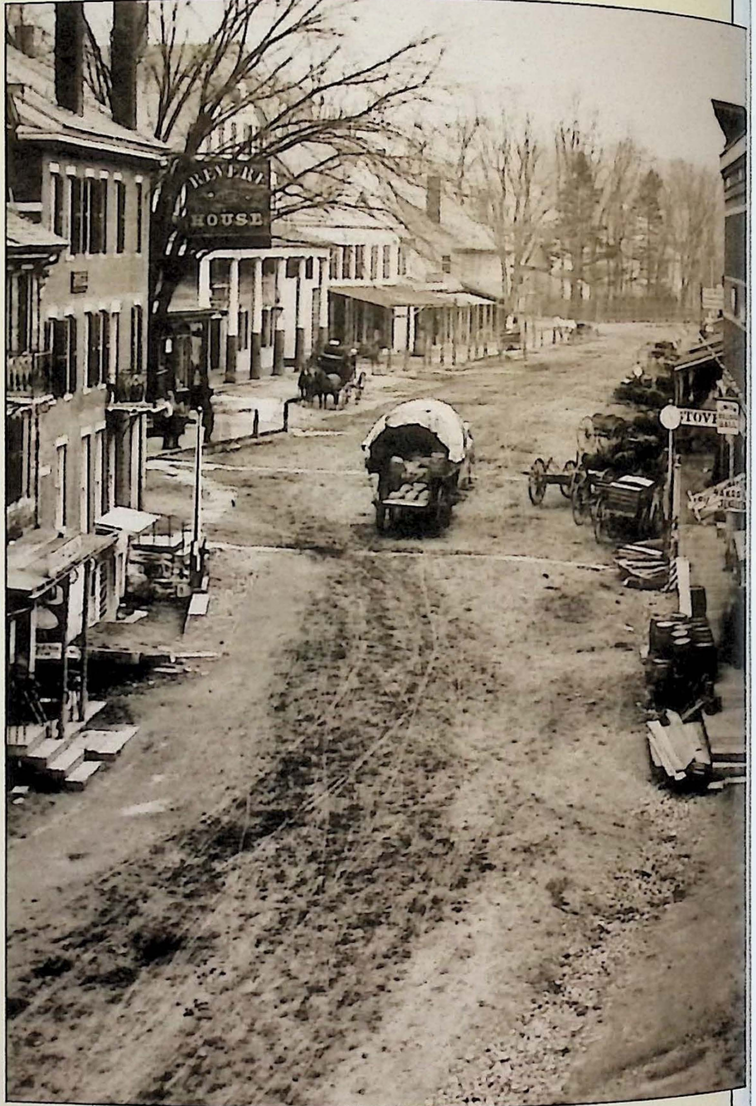
MAIN STREET BRATTLEBORO 1860

This is the scene looking north on Brattleboro's Main Street in 1860. The railroad had arrived in 1848, making Brattleboro a hub for lodging, travel, and business. On the southwest corner of Elliot Street (upper left here) stood the Revere House, a hotel operated by James Fisk, Sr., father of "Jubilee Jim," the financier of questionable integrity who was shot to death in Manhattan by Ned Stokes, rival suitor of the actress Josie Mansfield. The hotel was the setting for the younger Fisk's elaborate funeral in 1872, which featured a 200-piece band. In 1877 the Revere House was destroyed by fire.

In the next block north, the stagecoach left from the front of another hotel, Chase's Stage House (later The Brattleboro House), for towns to the west: Williamsville, Dover, and Guilford. Prior to the arrival of the railroad, Brattleboro was the junction for long-distance stage travel to Boston, Hanover, Hartford, and Troy. Shops and other places of business could be found along Main Street, many displaying their merchandise on wooden sidewalks with awnings providing protection from the sun and rain.

Mud, dust, and horse manure were constant problems for pedestrians. Flagstones or stepping-stones placed across the street enabled people in some places to step clear of the muck. The first floors of most buildings were many steps above street level to lessen the tracking of "street dirt" into the businesses. Steve Baker, current resident and local business owner, reports that in 1937 the previous owner of his buildings on Main Street deepened the cellars an additional three feet to allow the first floor to be lowered to street level.

Heading north is a heavy market wagon used to carry crops to market. Still decades away in 1860 were the trolley, automobiles, cobblestone paving, central water supply, storm drains, sewage treatment, and gas or electric streetlighting. One advance was hastened by a catastrophe in 1869, a fire that destroyed most of the west side of Main Street, prompting citizens to think about the need for a better water supply (see "Water Supply").



The photograph was taken by George Houghton from an upper window of the Van Doorn building (still standing on the corner of Arch and Main Streets). Houghton became known as "Vermont's Civil War Photographer" because of his pictures of Vermont soldiers at camp and on the battlefield. Photograph from the Brattleboro Historical Society.

ACKNOWLEDGMENTS

A book is a cooperative effort. We are deeply grateful to the following organizations and individuals who contributed to *On the Job*:

The Brattleboro Area Chamber of Commerce (Jerry Goldberg, Executive Director) for publishing the book;

The Thomas Thompson Trust (Susan Monahan, Grants Coordinator) for a major grant, and The Windham Foundation, Inc. (Dr. John Bramley, President, and Arthur Schubert, Vice President) for additional financial support;

Susan Kochinskas, Flocksholm Design, for designing the book; Harry van Baaren for image management; Douglas Goertzen for editing; Ben Tucker of GreenRiver.org for preparing PowerPoint images; Mary Lou Buchanan for historical research; Ken Wheeler for historic photo information; Jeff Nugent of Windham Regional Commission for water system information; and Eugene Hoyle of Hoyle, Tanner Associates, Inc. for technical information.

DEDICATION

We dedicate this book to the Brattleboro Department of Public Works. Steve Barrett and his staff were unfailingly generous with historical and technical information.

Gary Seymour

INTRODUCTION

ON THE JOB is about the people of the Brattleboro Public Works Department, who make it possible for you to drink from the tap, flush the toilet, and enjoy clean and lighted streets and sidewalks. But first, a little background.

During the 19th century, a rapidly changing technology led to an ever expanding industrialization of the country. As urban centers grew, drawing on both rural Americans and immigrants, the need for municipal services became acute. Brattleboro was not exempt. In fact, it mirrored what was happening in much of the northeastern United States.

Brattleboro's population increased in the 19th century with the arrival of the railroad (1848) and with various industries including the Estey Organ Company, the S.A. Smith Toy Company, and significant publishing and printing enterprises. And, in the early 20th century, the automobile arrived. But for many years, roads were limited, potable water sources were privately owned, the Whetstone Brook and the Connecticut River carried raw sewage, and firefighting was limited to hand pumpers and bucket brigades, no match for the devastating fire in 1869 that obliterated the west side of Main Street.

Today the department maintains more than 84 miles of paved and gravel roads, 600 culverts, and 30 bridges. Roads and sidewalks are plowed. In the spring street sweepers clean up the winter's sand and debris. Extensive signage was installed and is kept current. A pressurized water system was developed, first by a private individual, then by the municipality, which now provides water for domestic and industrial use and for firefighting. A sewage treatment plant was built in 1967 and is now scheduled for a major upgrade in the near future.

Oddly enough, the very success of the Brattleboro department — its quiet, often unnoticed provision of services — makes the inevitable exceptions all the more noticeable. Snow will fall, ice will form, potholes will emerge. The following photographs and text will address these challenges to our daily comfort but in a comprehensive context, both historical and contemporary.

The department has two divisions: Highway (including Lighting) and Utilities (including Wastewater Treatment, Water Treatment, and Distribution), with a maintenance crew serving all. Because many jobs require cooperation, however, we have organized the book mainly by work projects. In repaving, for instance, the Highway Division prepares the road bed, Utilities resets the storm drain grates and manhole covers, and an outside contractor spreads the asphalt, an example of public-private collaboration of benefit to both parties.

Two years of eye-opening experience on job sites with the department — asking questions, listening, and just observing — have dispelled any prejudices we may have had about men leaning on shovels. If you happen to labor under any such misconception, consider that the man who stands by while the backhoe deepens the ditch will soon be down in the ditch himself, wrestling a heavy pipe into position. To the task of keeping the town running, the department brings hard work, critical skills, and dedicated leadership.

It is our wish to add to the general knowledge of the town's municipal services and to foster a sense of pride in the Brattleboro Public Works Department. ■

WATER SUPPLY

Sunset Lake dam,
highest point of Brattleboro's
gravity-fed water system.

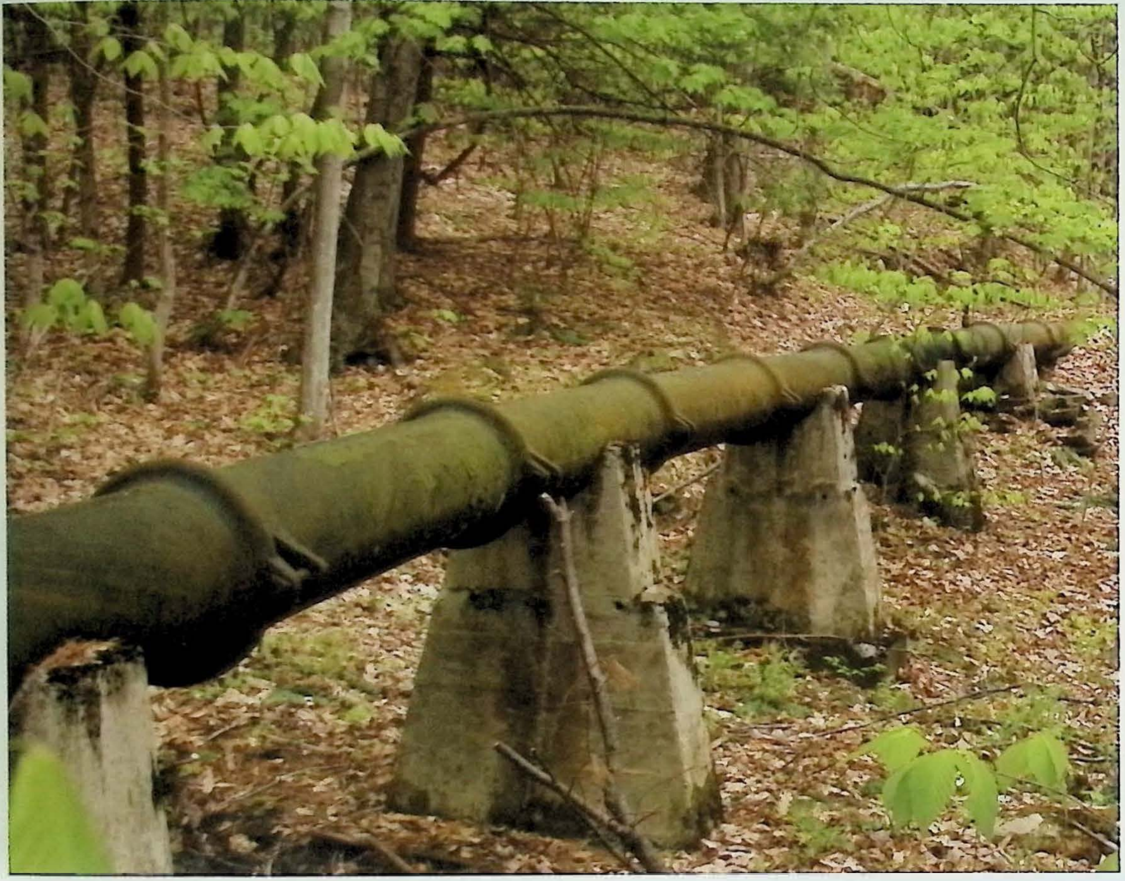
Most of Brattleboro's public water supply flows from mountain streams and springs into Sunset Lake Reservoir in Marlboro, drains into Stickney Brook in Dummerston, gathers water from that watershed, and then, in about two and a half miles, pools behind a diversion dam (so called because it allows some of the water to be diverted in another direction). At this dam the water enters a twelve-inch main. The Langille and Kelly Brooks also enter this twelve-inch main via smaller diversion dams downstream. Eventually the main empties into the Pleasant Valley Brook and then enters a settling pond behind a small dam, where coarse sediment and debris settle out. From there it flows into the big reservoir at Pleasant Valley, the main holding site of Brattleboro's water. It is then pumped up to the treatment plant, where certified public water system operators test and treat it before it goes to a three million gallon storage tank and then downhill via mains to supply the town. Two settling basins just below the dam receive water that was used to clean the plant's water filters. Here debris settles out before the water is released to a small tributary that leads to the Whetstone Brook.

(above) Stickney Brook tributaries feed system.

(below) Public Works Director Steve Barrett opens valve at Kelly Brook diversion dam to send water to the twelve-inch pipe.

The town also has a supplemental system, three wells in the Retreat Meadows. Certified operators test and treat the water on site and store it there in a 72,000 gallon underground tank from which it is pumped as needed to the north end and downtown areas of the town. The two systems together, Pleasant Valley and the Meadows, provide daily about 1.42 million gallons of water, which Public Works employees process and test, taking daily samples from different pumping stations, distribution sites, and the treatment plants themselves. Few citizens ever take notice, unless, of course, something happens to the supply (drought) or distribution (water main break).

Brattleboro was not one of the many "planned communities" that sprang up in the United States after the Second World War, when developers created Levittown, New York, and Reston, Virginia. In those communities, water supply, schools, and streets all started on a drafting table. In Brattleboro public services developed as needs changed. As a case in point, a major fire in 1869 destroyed most of (opposite) Stickney Brook diversion dam.



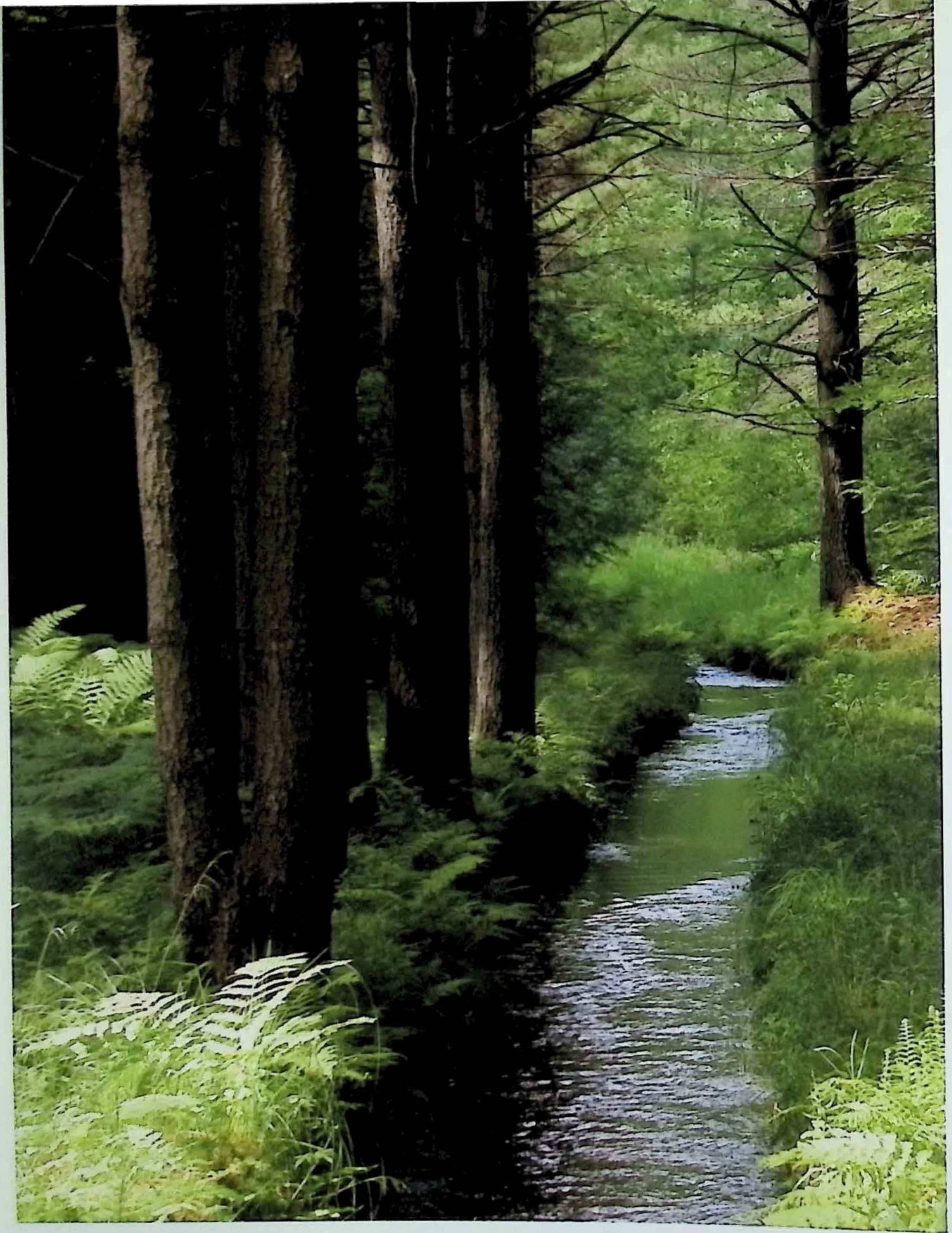
(above) Elevated twelve-inch pipe maintains appropriate grade.

(right) Water leaves twelve-inch pipe and enters Pleasant Valley Brook.

the west side of Main Street, clearly demonstrating that there was not enough water supply or pressure to fight such infernos. Hand pumpers and bucket brigades were simply not up to the job. Many Brattleboro factories during this time also suffered devastating losses. The Estey Organ Company maintained its own firefighting equipment and large cisterns to protect its factory buildings.

Before a general water system was developed, most homes and businesses drew on springs or hand-dug wells. Without pressure, however, water was hand-pumped from its source, until individual and shared cisterns allowed for storage and pressure. Because of Brattleboro's hilly topography, stored water moved by gravity in a controlled way without the need for pumps. But the demand required even more storage and a greater elevation.

And here enters one of Brattleboro's most interesting and enterprising citizens. George Crowell moved to Brattleboro in 1866 and founded the highly successful women's magazine *The*



Pleasant Valley Brook straightened and graded by the Works Progress Administration (WPA).

Pleasant Valley reservoir as seen from dam.

Settling basins for treatment plant filter water.

Household. Like his fellow businessmen, he saw that the town needed a better water supply for fire protection and domestic use. Combining business opportunity with civic responsibility, Crowell developed a spring-fed distribution system for the downtown area around 1880, and in 1882 purchased from Isaac Hines the partially completed reservoir on what came to be known as Chestnut Hill. Crowell's plan became operational in 1888, and he had two fire hydrants installed on Main Street, which provided pressurized water. Crowell also developed a park around the reservoir for public use.

As Brattleboro continued to grow, even Chestnut Hill's five million gallon capacity was unable to keep pace with demand. Having already anticipated a shortage, Crowell developed a plan to pump water from the West River into the Chestnut Hill Reservoir, using a steam-powered pump and six-inch mains.

Crowell's plan caused debate: Should Brattleboro build its own municipal water system and incur the acquisition and operational costs? In 1892 the town appointed a committee to study Crowell's operation. Brattleboro at the same time sought and received from the State of Vermont authority to develop its own system but decided instead to accept Crowell's, including the West River source, which became operational in 1893. Crowell continued to buy land and water rights. He saw that the overflow of Sunset Lake could be combined with Stickney Brook and collected in a large reservoir to be constructed in Pleasant Valley. From there it would pass through new mains to users in town. Sources in Marlboro, Dummerston, and the northwest corner of Brattleboro, higher in elevation than Chestnut Hill, would provide not only greater volume but also the much-needed pressure.

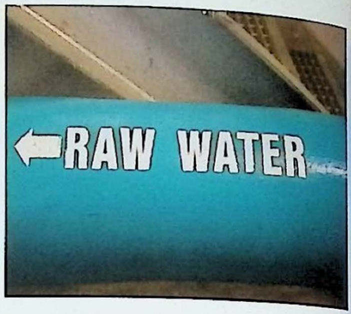
The question arose again as to whether Brattleboro should build its own system. As of August 1, 1905, Crowell was prepared to sell the Chestnut Hill Reservoir and the water rights to Sunset Lake and Stickney Brook for about $200,000. But again, Brattleboro chose neither to build nor to buy but to continue using Crowell's water for a fee.

In November 1905 Crowell began work on the Sunset Lake and Pleasant Valley sources. A newspaper headline cheered: "Brattleboro's New Water Supply — Abundance of Water Adequate for all Domestic, Fire, Elevator, and Light Manufacturing Purposes." (At the time pressurized water was used to raise an elevator.) Another headline proclaimed: "Village Water Supply to be Greatly Increased by New System. Sunset Lake Water Company will Develop the Stickney Brook Water Rights and Connect with the Chestnut Hill Company's Main." In 1909 the question of public ownership came up once again. After much discussion the town proposed $250,000 for the Chestnut Hill and Sunset Lake systems, but by this time Crowell wanted $345,000 and rejected the town's offer. For years Crowell had met most of the town's water needs. As a private businessman, he had more flexibility than the town to act decisively, and fortunately he had the foresight to expand his operation.

First chlorination facility, 1955, with 1971 addition.

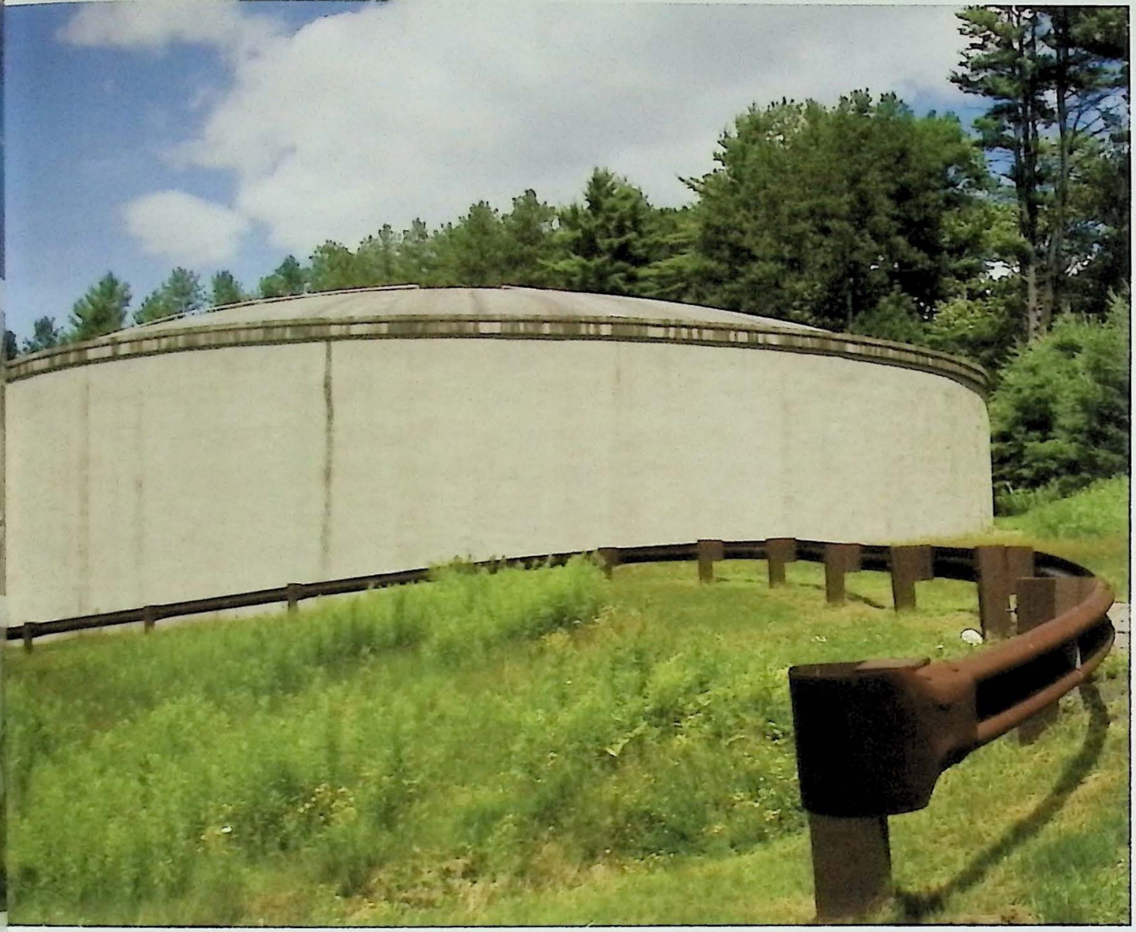
Corwin S. Elwell Water Treatment Plant in Pleasant Valley.

(left) John Highter at treatment plant.



It was not until 1925 that the town finally bought Crowell's system, paying the significant sum of $550,000. Crowell had died on October 20, 1916, but before his death he had offered the park at Chestnut Hill as a gift to the town. Ever cautious, afraid of the cost of upkeep, the town rejected the offer. After Crowell's death the park fell into disrepair, and all the many features such as the gazebo, benches, and bridges along the footpath rotted away. Gone, too, were the park's chestnut trees, victims of disease in the early 20th century. Eventually Crowell's son, Christie, formed a real estate company with other businessmen and sold off the park as building lots. The reservoir remained part of the system until 1972, when it was disconnected. Prompted by safety and liability concerns, the town may decide to remove the reservoir, erasing yet another trace of George Crowell's early efforts. But Crowell himself is remembered as a man of vision who gave Brattleboro its water.

Since taking over the system in 1925, the town has made many improvements as problems arose or greater demand was



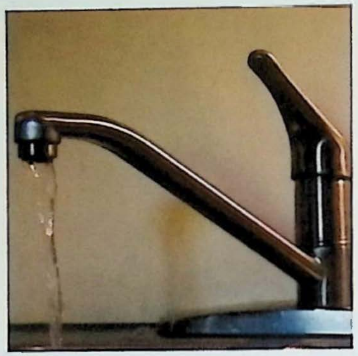
Filtered and treated water ready for distribution.

Brian Filgate at Carriage Hill pumping station, which maintains pressure at times of heavy demand.

Retreat Meadows treatment plant.

anticipated. The 1929 Town Report mentioned an infestation of "organisms" in the water, "giving the water a disagreeable taste," but cleaning, disinfecting, and covering an exposed part of the system eliminated the problem.

As the demand for water grew, the town took additional steps to ensure adequate supply, pressure, and potability. In the mid-1930s the Works Progress Administration (WPA) straightened the brook that runs from the end of the twelve-inch main to Pleasant Valley, shortening it by 200 feet. To control its banks, workers laid up stones, which are still in place today. (As a controlled flow, it is spared the extreme fluctuations and stream bank movement of a natural stream.) The project also lowered the bed, creating a fall of 6 inches over 100 feet and eliminating several stagnant ponds. The WPA was a federal program to provide jobs for people out of work because of the economic depression that swept the United States. Workers received about $50 a month.



Ready to drink.

(above) John Highter taking a sample at Retreat Meadows.

(right) Stephen Reynolds at work at Retreat Meadows plant.

During WWII the expansion of the system slowed because it was hard to find materials and manpower. The staff shortage is noted in Assistant Superintendent Justin Holden's poignant comment in the 1942 Town Report: "To our three employees now in the Armed Forces, two of which left this year, I wish to pay tribute, and may God grant their safe return to us." The men were Hap Atkins, Eddy Allen, and Raymond Woods, all of whom did return.

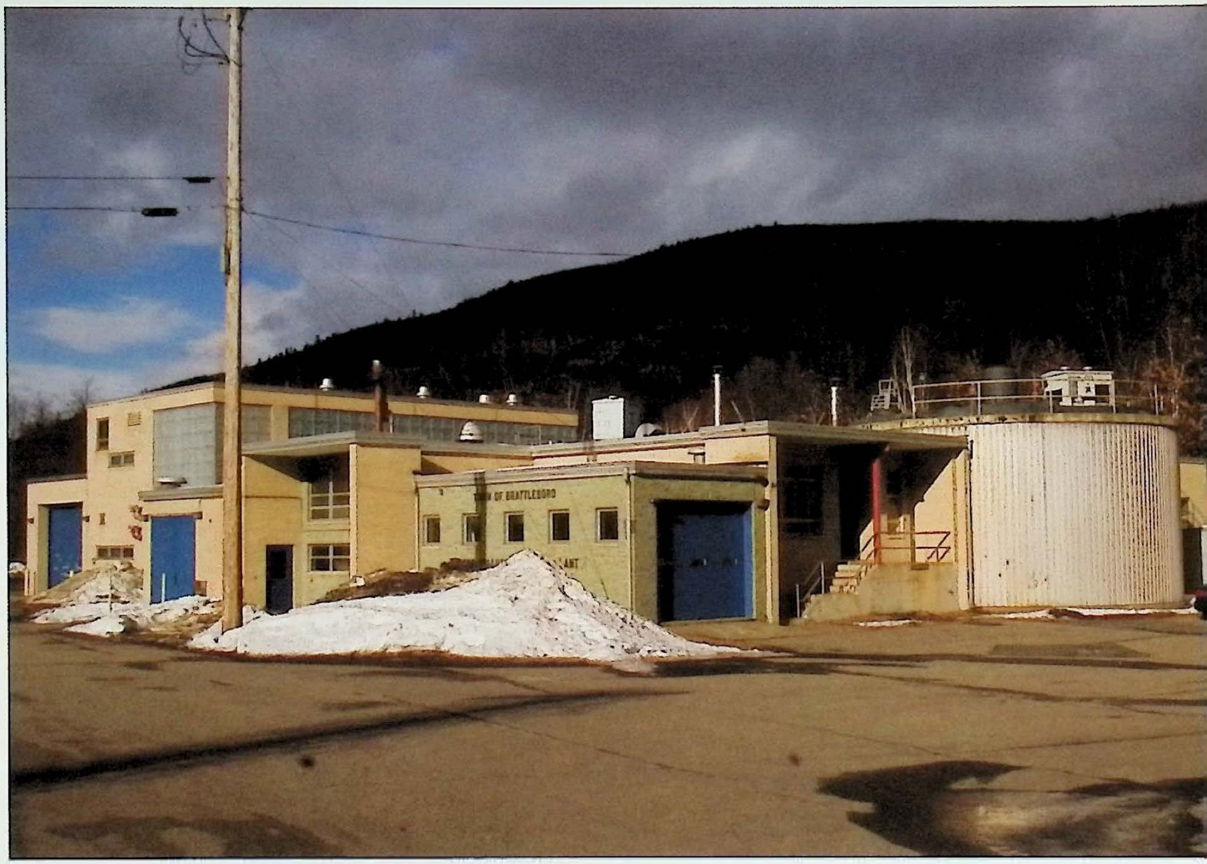
During the post-WWII period, Brattleboro's development and several droughts led to major improvements in the water system: a greater supply, greater storage, less waste, and a cleaner product.

In 1955 the town raised the height of the Pleasant Valley dam to increase the reservoir's capacity and built a small chlorinating plant at the site. To ensure supply and increase pressure, it built a one million gallon storage tank at Black Mountain in 1966; tanks at three other locations followed. Next came the new wells and treatment facility at the Retreat Meadows that were used for the first time in 1970. Also in the early 1970s, water meters began to replace the old practice of charging users a yearly fee based on the size of their mains regardless of the gallons used. And in 1990 the town built the present treatment facility at Pleasant Valley and dedicated it to Corwin S. Elwell, Town Manager from 1960 to 1989.

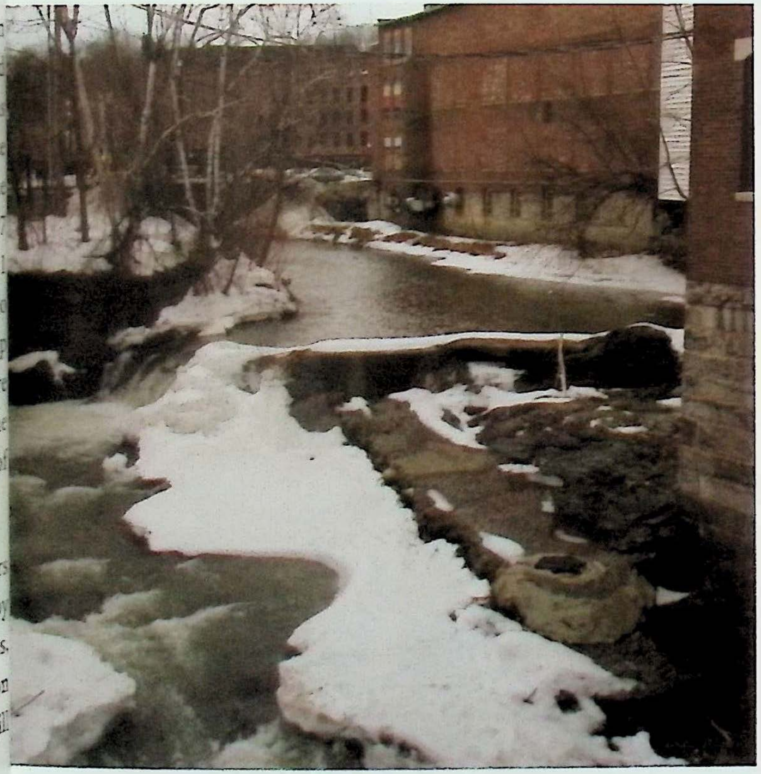
Fire protection as well as domestic supply has been a water system concern since the beginning. As early as 1928, the New England Insurance Exchange recommended additional and larger mains for better coverage. Today the Vermont Insurance Services Office inspects water systems and fire departments and rates the municipalities; these ratings affect the pocketbook. In 2007, Brattleboro received a rating of 3 on a scale of 1 to 10 (with 1 being the highest) for its most populated areas. According to Mark Richards and Cathy Coonan of the Richards Group insurance agency, insurance costs directly reflect the level of fire protection. Fire Chief Michael Bucossi speaks of the pride the firefighters take in their role in earning this rating, an example of the close interdependence among town departments.

Now in 2009 the Brattleboro Public Works Department delivers water to its citizens for domestic use and firefighting by maintaining 2 reservoirs, 5 pumping stations, 52 miles of mains, 514 fire hydrants, 2 water treatment facilities, and 18 distribution sample sites. And, as ratepayers know, the department still manages to read 3,600 meters every quarter. ■

WASTEWATER TREATMENT



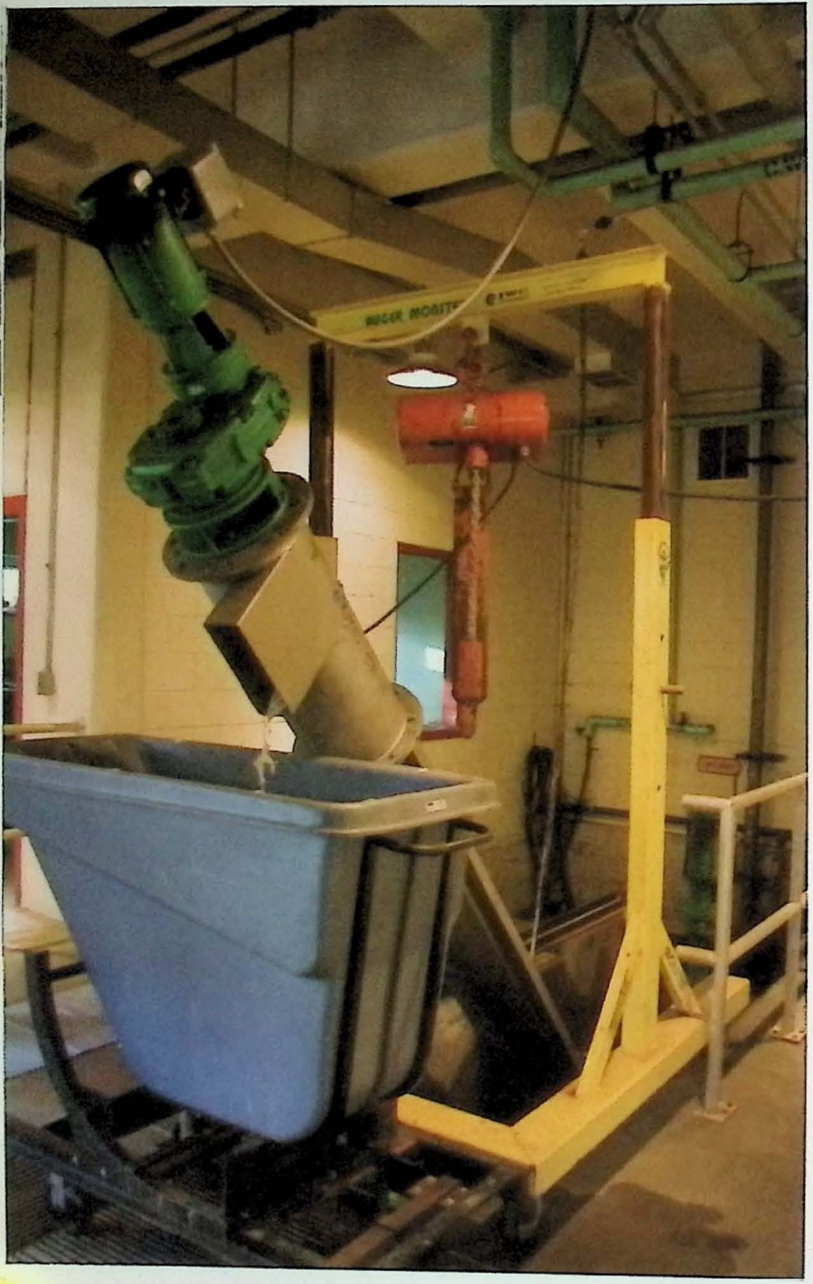
(right) At back left, headworks section where water that began at Sunset Lake, now carrying waste, enters the plant for treatment. Digester section in right foreground.



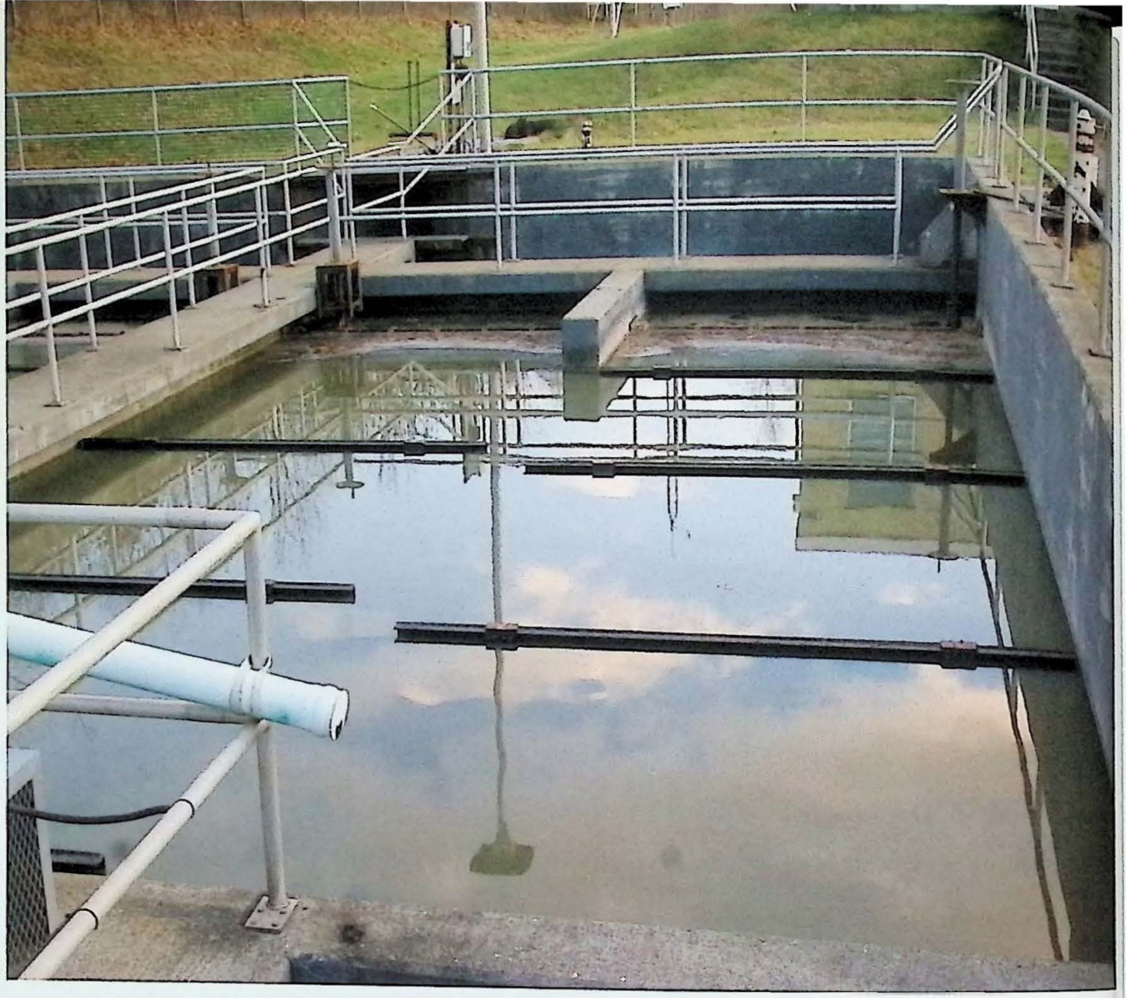
(left) Circular object, lower right next to Wilder Building, is top of manhole to sewer line running on bed of Whetstone Brook on way to treatment plant.

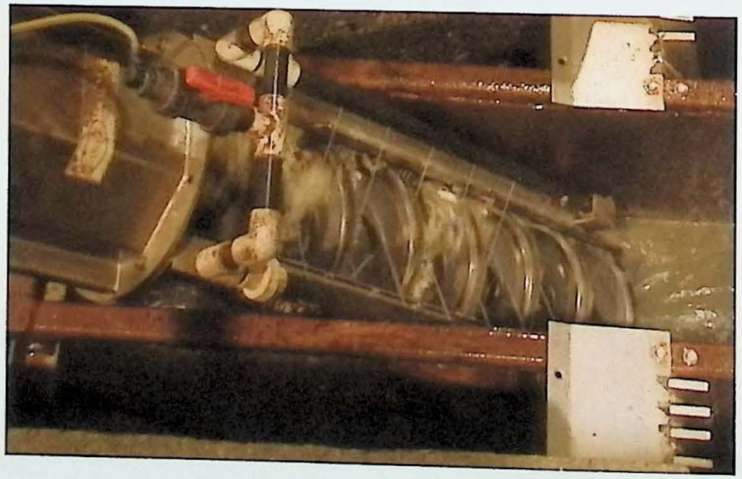
Certain realities are best dealt with allusively. "Wastewater" is the widely accepted euphemism for the mixed stream that flows from our sinks, showers, and toilets into drain lines and from there, ultimately, to our waterways. How it gets there is critically important and has changed significantly over time.

In the old days, people's attitude toward public sanitation was casual. In rural areas, such as Brattleboro, many swimming holes enjoyed by young and old were undoubtedly contaminated;



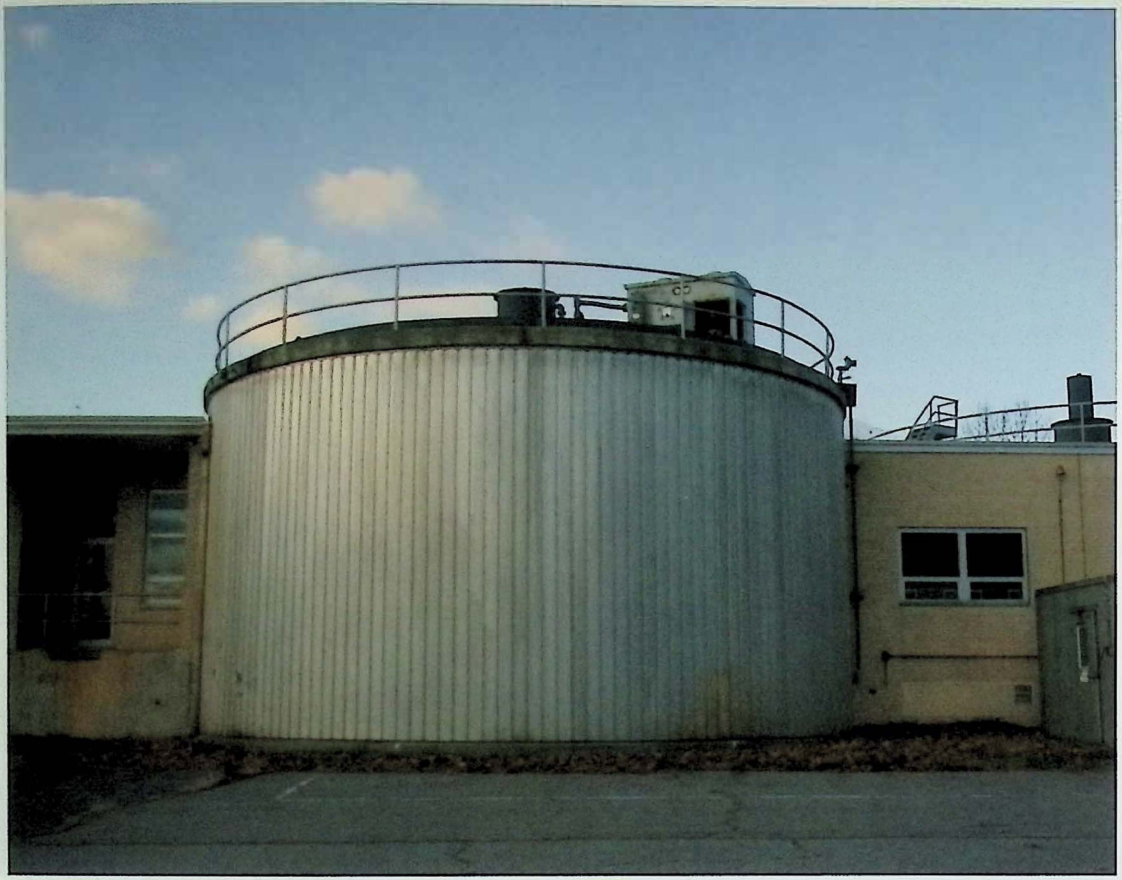
Auger Monster removes rags and other coarse debris as waste enters plant in headworks building. Cart shown here is wheeled to another room and emptied into dumpster.





(above) Primary settling tank where, after coarse debris and grit have been removed, organic matter settles out as sludge and moves to digester. Fats and grease rise to top and are skimmed off manually. Water stream moves on to rotating biological contactors.

(left) Looking down at close-up of auger. In the part of the stream that bypasses the auger, debris is captured by these toothed devices (manual bar screens), which must be raked off by hand twice daily.



Round middle section is a primary digester, which heats and mixes sludge, producing methane gas.

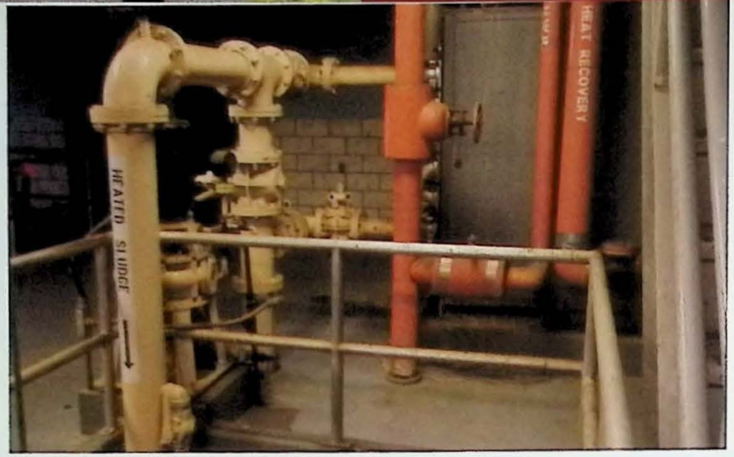
several were on the Whetstone Brook and the West River. The thinking back then was that if the wastewater was diluted enough, the problem of its disposal was solved. Brattleboro's wastewater originally drained into nearby streams with a year-round flow. The Whetstone Brook, in addition to powering mills and factories, served this purpose, as did the West River. The swift current of these waterways and the fact that they discharged into the larger Connecticut River made them a natural choice. Brattleboro was not alone in this method of wastewater disposal. Most cities and towns did the same through the 19th and well into the 20th centuries. Curiously enough, this method of disposing of wastewater was a marked improvement in public health over the cesspools and sewage ponds that had spread devastating diseases in the larger cities. It was hardly the perfect solution, however, for the streams were polluted, as was sometimes visible in the solid waste left along the banks in low water.

In the 1960s Brattleboro's health officer, Dr. Lester H. Lovell, an outspoken advocate of cleaning up the town's waterways, recommended the installation of sewer mains and a sewage treatment plant. (In those days the term "sewage" was heard more often than "wastewater.")

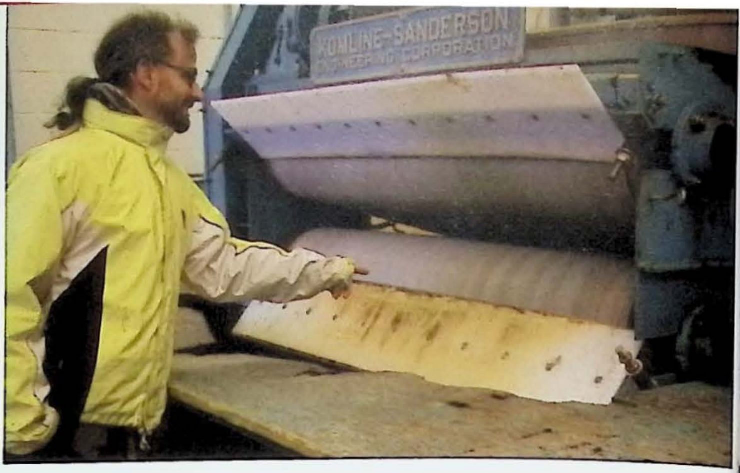
Perhaps it was the stench, as much as the public health menace, that garnered public support for these proposals. But outside regulatory pressure also played a part.

Town Manager Corwin Elwell wrote the following in the 1964 Brattleboro Town Report: "As I have stated previously and on several occasions, it is mandatory that this project [sewer mains and treatment plant] be approved and in construction not later than 1967, or all further development within the community, both residential and industrial, must cease. This by order of the Water Resources Department [a State of Vermont agency], which must approve all sewer extensions and additional connections to our sewer system. This situation makes it necessary that we proceed with the project without undue delay to insure the future progress of Brattleboro."

The following year the Town Report carried this message from Dr. Lovell: "The Connecticut River Interceptor [sewer main], Putney Road and the Sewer Disposal Plant are ready to present to the Representative Town Meeting. The Health Department strongly urges passage of this forward looking project. The

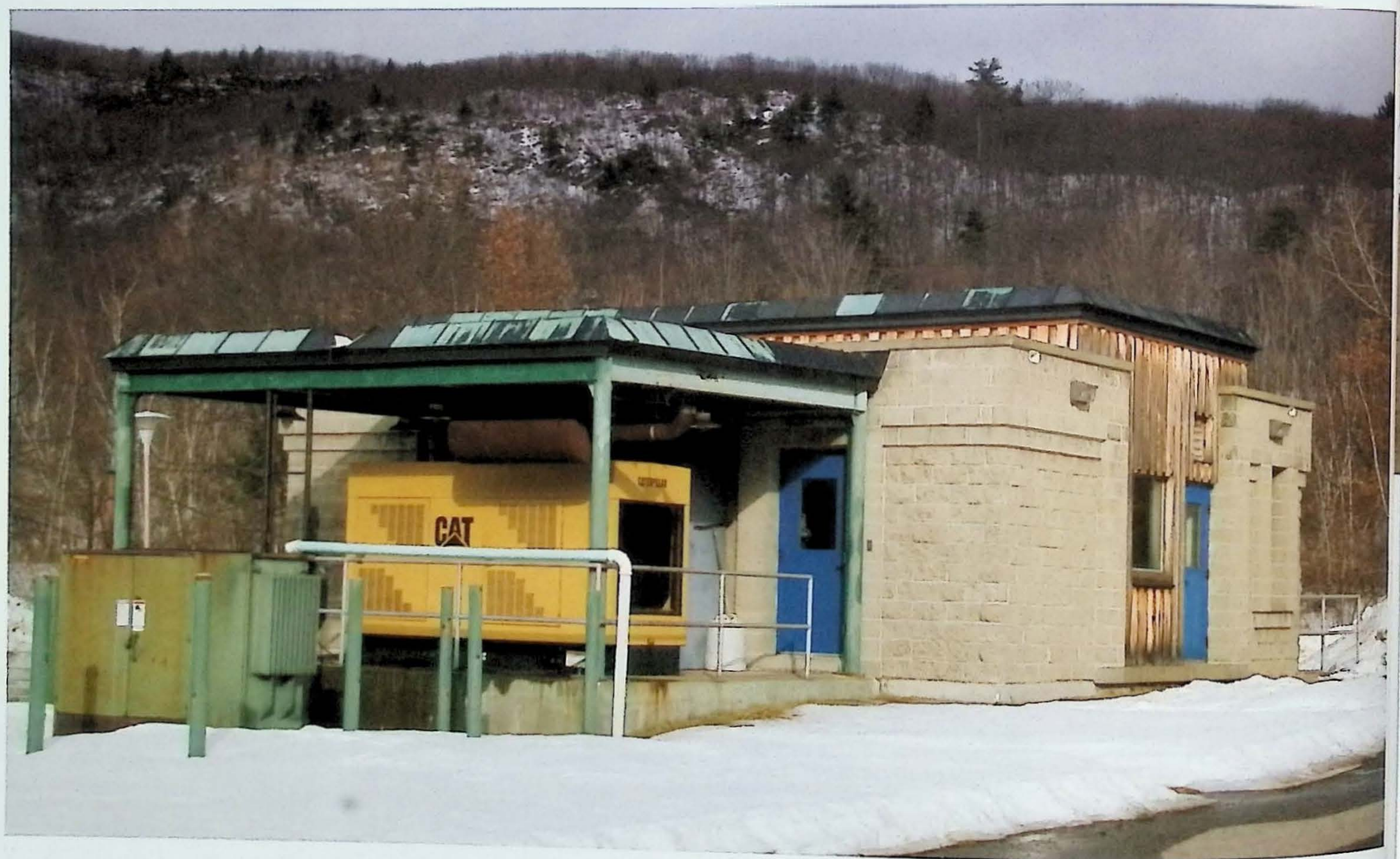


Sludge is both preheated and recirculated for continuous ninety-two to ninety-six degree heating by gray fuel-oil boiler in background. Boiler also heats building.



Neal Tozier points to belt filter press, which dewaters sludge by squeezing it between porous belts and rollers.

(above) Methane gas produced by digester is burned off. Upgraded plant will use methane for heating and electricity.



(right) Primary effluent pump building and emergency generator that can run the entire plant. Pump raises waste stream grade up from primary settling tanks so that stream can flow down to rotating biological contactors.

Rotating biological contactors in which bacteria continue to decompose organic waste.

sanitary land fill dump became operational during the year and we commend this as a forward step in public health."

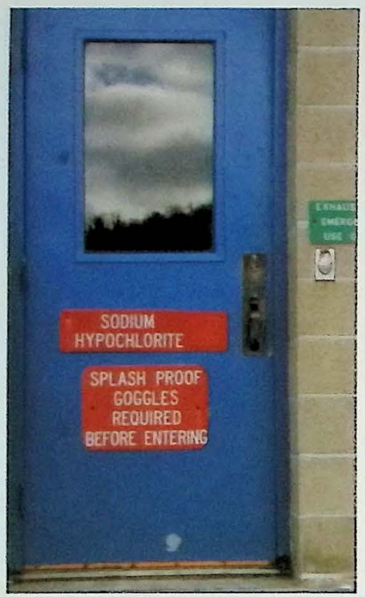
Before the plant was built, newly constructed sewer mains directed the flow of waste into the Connecticut River. Instead of raw sewage flowing down the Whetstone, a sewer main was laid on the bed of the brook; its manhole covers are still visible from the Kyle Charles Gilbert Memorial Bridge (Main Street Bridge). This kept wastewater from mixing with fresh water until it reached the Connecticut at Arch Street. Today this main is still operational, but instead of going straight to the river, it connects with additional mains, which carry the waste to the treatment plant. Prior to the construction of the plant, buildings along Main Street discharged their wastewater directly into the river.

It was 1967 before Brattleboro started its first treatment facility, located between Vernon Road and the Connecticut River. It was a primary treatment plant in which solid waste settled in large tanks before being taken to a landfill. The remaining water, still polluted, was discharged directly into the Connecticut.

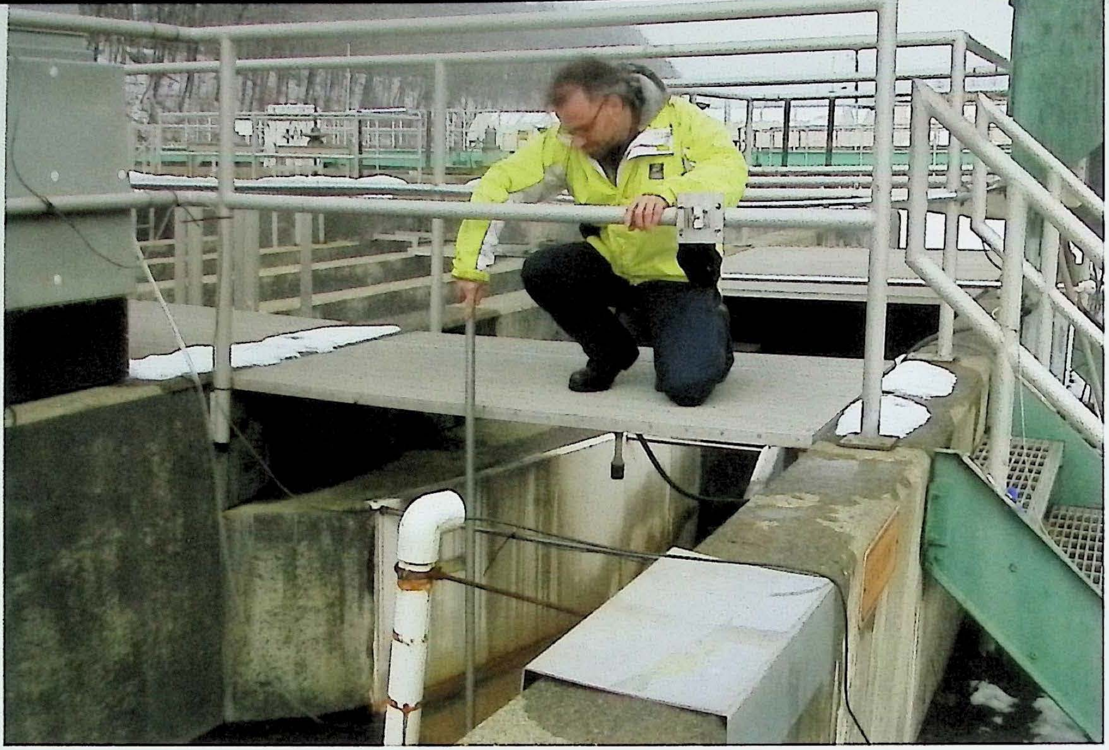
In anticipation of the new plant, locating and redirecting the mains was no easy task because many had been installed when there were few maps and little emphasis on record keeping. Steve Barrett, the current Director of Public Works, recalls the many stories told by the Public Works crew working on the project. Just when they felt they had identified all of the mains that emptied into the Connecticut, they would discover another when a tracing dye was flushed down a toilet to emerge as a colorful plume in the river.

In 1972, however, the federal Clean Water Act required municipalities to address water pollution more aggressively. This legislation led to the upgrade in 1984 of Brattleboro's plant to a so-called secondary facility. The secondary process, as described below, treated the water that was discharged into the Connecticut River.

To understand the workings of a wastewater treatment plant, think of the human digestive system. The treatment plant works in a similar way, only in reverse. Heavily polluted wastewater enters the plant and, after digestion, is excreted in a much less polluted form. This is accomplished by using mechanical, biological, and chemical means in a two-step process, primary and secondary.

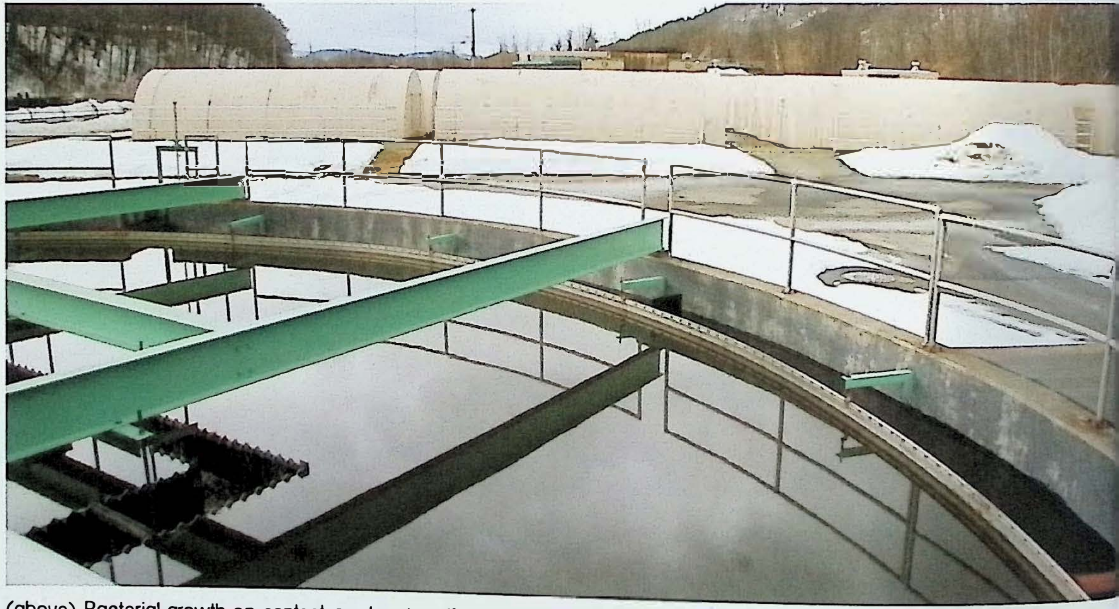


Chlorine is dangerous, as entrance to storage building indicates.

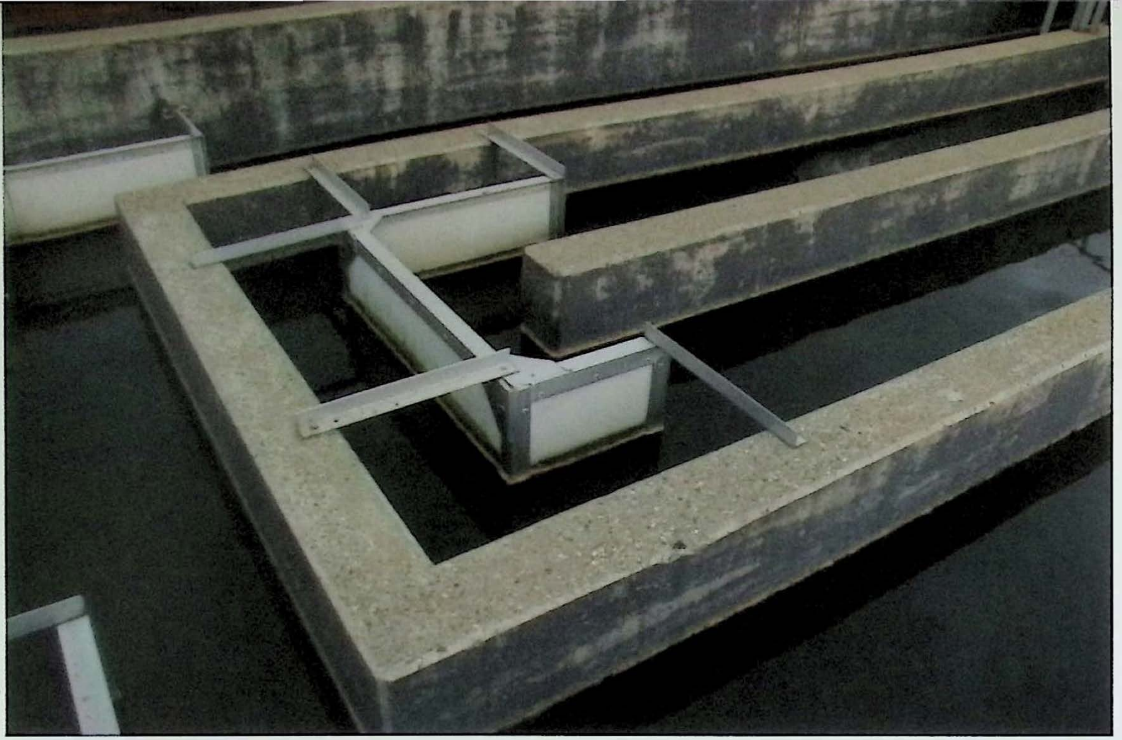


(left) As part of monitoring process, Neal Tozier takes sample from chlorination tank, the final test before water enters the Connecticut River.

Chlorine arrives by tanker truck to be stored in 2,000-gallon tank in this building, and is then fed at a precise rate to water in chlorine contact tank.



(above) Bacterial growth on contactors sloughs off, passes to secondary clarifier (foreground), settles as sludge, then returns to primary settling tanks. Water goes on for chlorination.



(above) Channels in chlorine contact tank slow waste stream to give chlorine time to work.

In the primary process, when the wastewater first enters the plant, an auger and steel grids trap rags and larger debris. The stream then passes to the first settling tank, wide and deep enough to slow the stream and allow sand and grit to settle out. From this tank grit slurry is pumped to an auger, which lifts it and allows water to drain out. The grit goes to a container to be taken to the landfill.

The remaining wastewater flows to the primary settling tanks, which are much larger than the grit tank, slowing the water flow even more. Here organic material settles out to form sludge. The sludge then travels to a digester, a large sealed tank without oxygen. The sludge is kept at ninety-two to ninety-six degrees, enabling anaerobic bacteria (living without oxygen) to kill some of the pathogens and decompose the organic matter. A by-product of this process is methane gas, which in the upgraded plant now on the drawing boards will power a generator for electricity and fuel a boiler for heat.

In about two weeks, the digested sludge no longer produces methane gas and has 50 percent less solid matter than when it entered the tank. Polymer is then added to the sludge. Polymer causes small particles to cling together, clumping the sludge in a more compact mass. This helps in the next step, a mechanical pressing that removes more water, making the disposal of the sludge at the landfill less expensive because of its reduced weight and volume.

In the secondary process, the remaining wastewater flows to rotating biological contactors (RBCs). These are rotating drums, twenty-five feet long by twelve feet in diameter, which are partly under water. The soluble organic solids from the wastewater cling to the drums, and when exposed to air, their aerobic bacteria acquire oxygen and multiply. When the solids are submerged in water, the invigorated bacteria further decompose them. Additional sediments drop out before the water enters the chlorine contact tank, where it is disinfected. The water is then discharged into the Connecticut River. Certified plant technicians take daily samples of the wastewater stream, which are analyzed by an on-site or outside laboratory.

Plans are currently under way to upgrade the plant once again. An engineering firm has provided the town with the draft of a conceptual design report. This report identifies what upgrades are needed to bring the Brattleboro facility into compliance with current regulations and to operate more economically by improving efficiency. Upgrade costs and benefits are identified.

The report addresses expanding the plant's capacity, automating certain operations, reducing the cost of lighting and heating, and improving the quality of the water that is eventually discharged into the Connecticut River. ■

Brian King closes lid on paint shaking machine.

(opposite) 10:00 P.M. Matt Ogden tests sprayer at town garage.

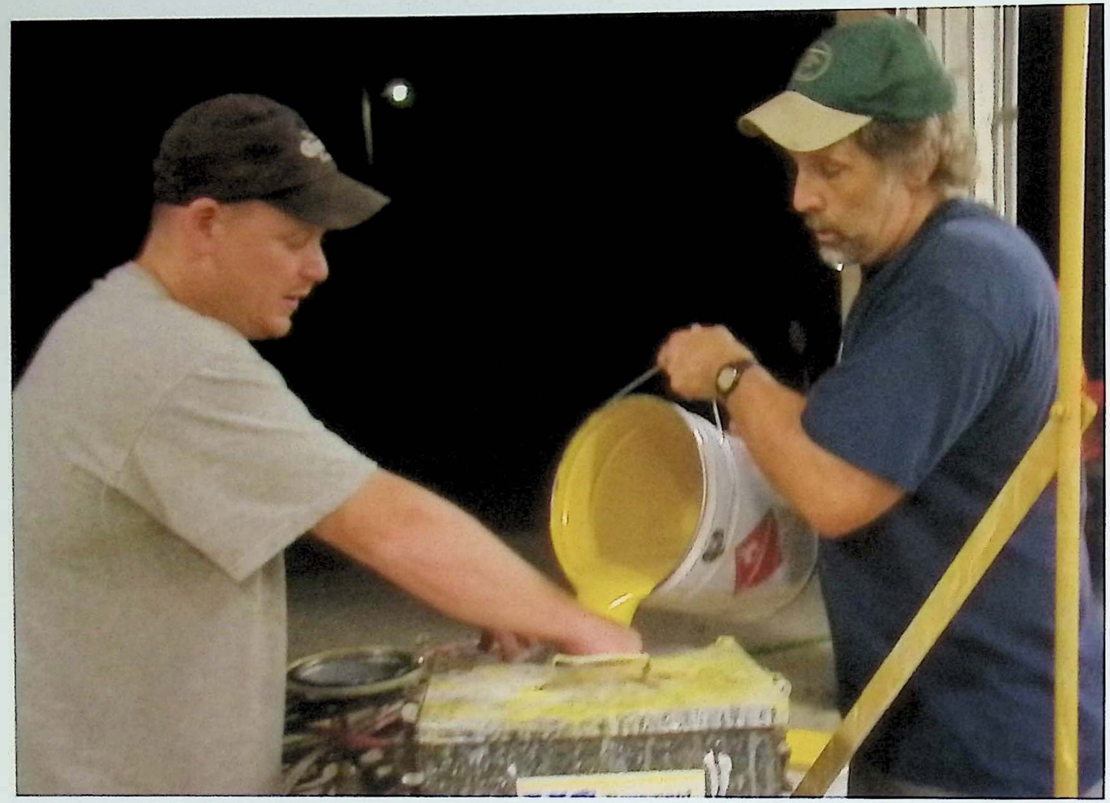
(left) Scott "Scooter" Fowler cuts screening for paint filter.

ROAD SIGNS

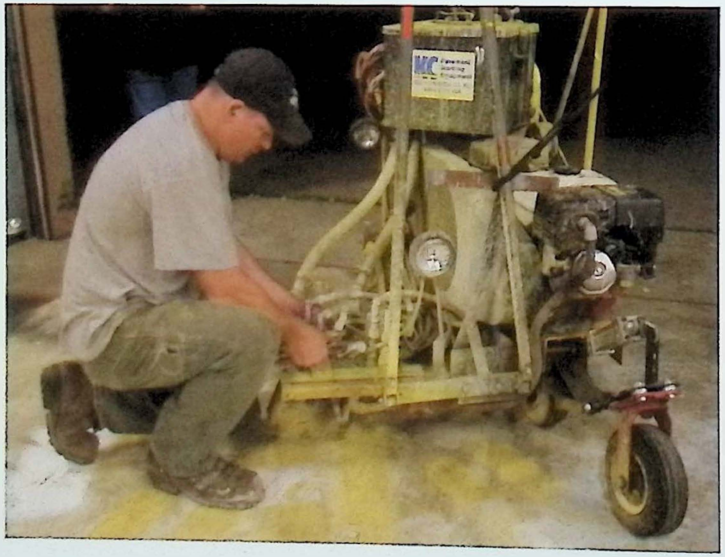
Early roads connected communities and were simply named for their destination. In Brattleboro, for instance, Putney Road leads to Putney and Marlboro Road to Marlboro. If road signs were needed, they were placed at intersections, letting the traveler know which way to go.

A "post" road, such as the Boston Post Road, was the route the mail traveled. This route required many markers, called milestones or mileposts, that indicated the miles from the Boston border or, if traveling in the opposite direction, from the intersection of Wall Street and Broadway in New York City. These markers helped determine travel time, but most early road signs only gave directions. Warning signs and road striping had not yet made their debut, although snow and mud season may have prompted some temporary warning signs about a road being impassable.

In the 1800s most roads were made of dirt or gravel. However, by the early 1900s, when the automobile arrived, some roads were improved with paving. These road upgrades were supported by automobile manufacturers and were welcomed by automobile owners. Many private organizations and regional automobile clubs, who maintained the roads, introduced "route numbered" road signs that offered directions and promoted their organizations. In 1902 these clubs formed the American Automobile Association, and in 1905 they published their first road map. Traffic increased as a result of these efforts, and road signs started to be standardized with directional and safety-related information. This standardization was further developed through government action with the creation in 1914 of the American Association of State Highway Officials. One of these early efforts is still seen today, the standardized and familiar octagonal stop



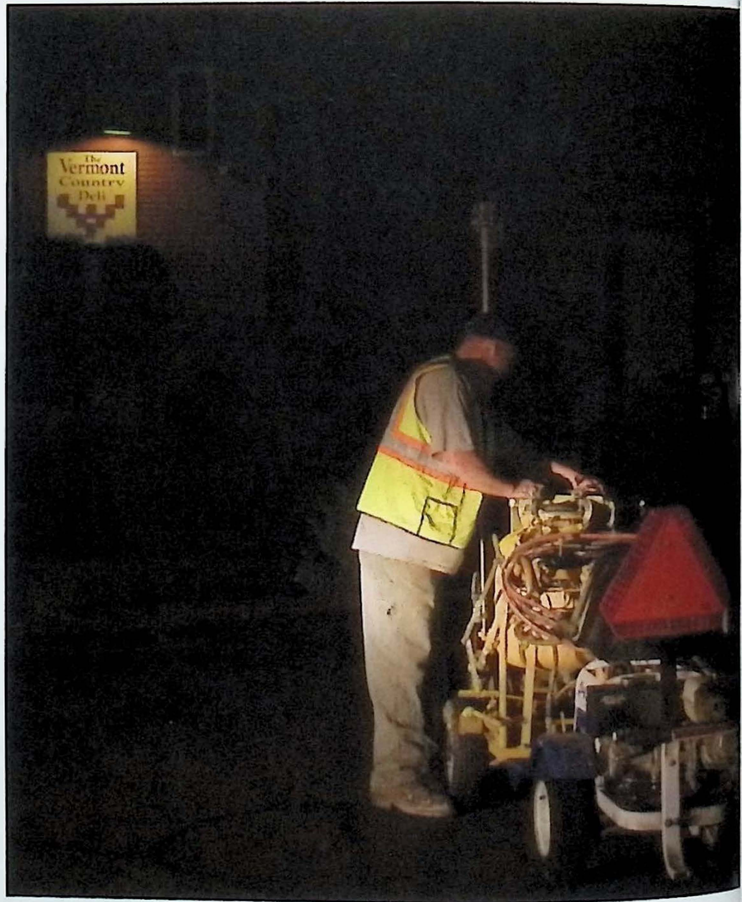
(above) Matt Ogden (left) and Brian King fill sprayer.

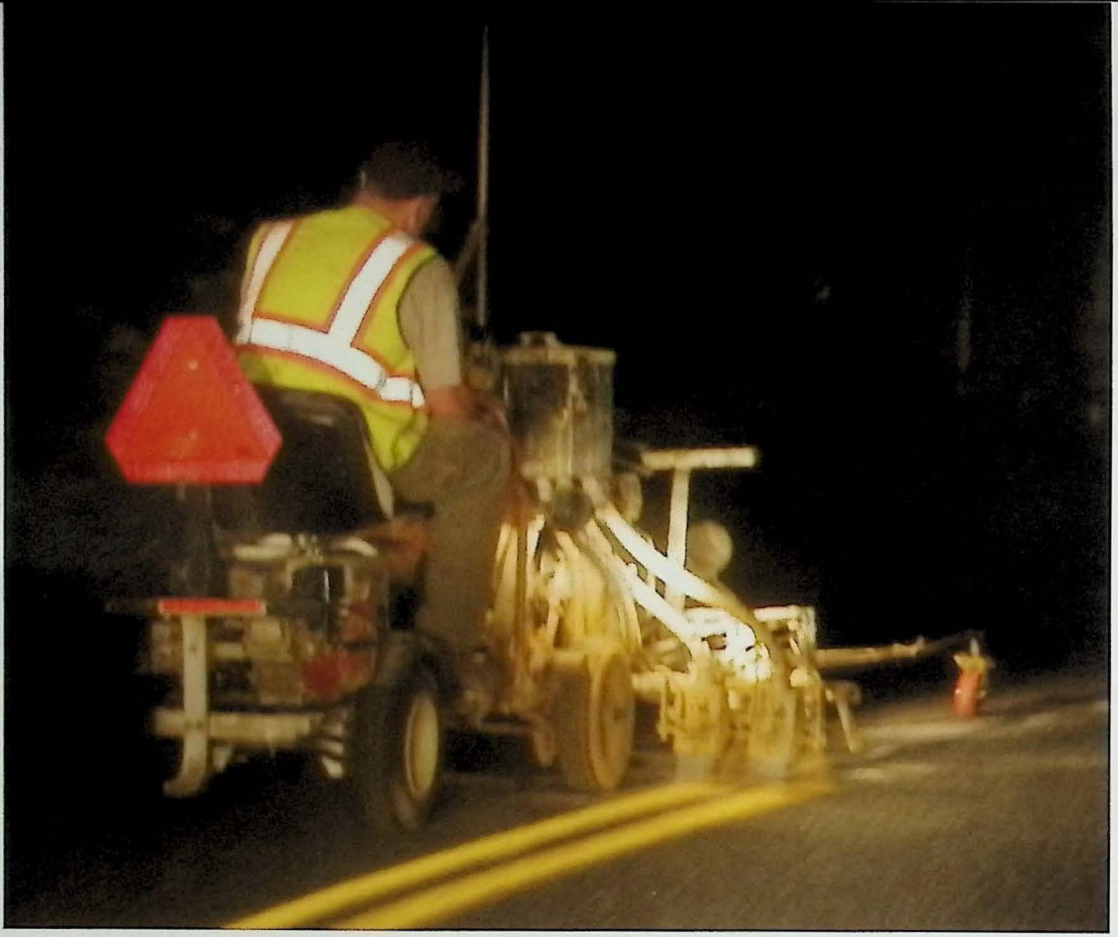


(right) Matt Ogden adjusts spray nozzle.

Empty cans stacked up. Thirty-five gallons used for Williams Street alone.

(below) Matt Ogden readies sprayer at head of Williams Street.





(above) Matt Ogden paints double line on Williams Street.

(left) Brian King follows sprayer and sets cones.

sign — the only octagonal-shaped sign in use. The international sign format for "No," a red circle on a white background with red diagonal line through it, tells of a restriction, whereas the yellow triangle offers a warning. Their meaning is easily understood.

Today the Federal Highway Administration publishes the *Manual of Uniform Traffic Control Devices*, which is updated periodically and is considered the official U.S. guide, determining, among many other things, what a road stripe or sign should look like and where it should be placed. A glance at the manual's table of contents leaves one with the impression, echoing Hallmark, that there is a sign for every occasion. This publication is the standard that Public Works employees use for their work.

The Brattleboro Public Works Department is responsible for much of the road signage, including automatic traffic signals. The department maintains a large inventory of signs to replace damaged ones. It also has the capability to make signs at the garage. Some, however, such as the freestanding crosswalk signs, need to be special ordered from a sign company.

Traffic signs and lights must be repaired as occasion requires, but winter weather guarantees that road striping repair will be on the agenda every year.

In the spring, when the weather warms up, workers in the Highway Division prepare the equipment needed to repaint the town's pavement markings. Striping must be done at night when there is less traffic. Because there is limited storage space at the Public Works garage for the special paint that is used, it must be delivered incrementally by the supplier. This undertaking involves considerable coordination of schedules. Before heading out to the streets, the men at the garage check the nozzles on the road-striping machine and set the sprayer size. They use a machine to shake the paint, one five-gallon bucket at a time; they stack bagfuls of tiny

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RESURFACING AND REBUILDING ROADS

Many of today's roads are adaptations of animal paths. To accommodate wagons, these simple trails through the countryside were widened and hardened, but travel could still be difficult. The inadequate substructure and poor drainage led to ruts, washouts, and mud. Then, in the early 19th century in England, John Loudon McAdam developed a road structure, "macadam," consisting of a crowned subgrade covered with three layers of stone, with side ditches for drainage. A heavy roller locked the angular stones in place.

(opposite) Matt Ogden breaking up old road surface.

(right) Backhoe pushing asphalt into front loader.

Adequate drainage is, in fact, one of the major challenges of road construction. McAdam's design addressed this problem and is of great importance in road construction even today. Interstate 91 is a good example; the roadbed is elevated and the surface crowned, both of which allow water to drain away.

With the arrival of the automobile, paving these early dirt roads became more important. Since the roadways were already established, little thought was given to rebuilding the base to support a harder, crowned road surface. Many roads were simply covered with a material that was harder than dirt. Cobblestone, for example, was used to pave Brattleboro's Main Street (see p. 35). Other techniques included tarring the surface to help hold the road together and reduce the amount of dust in the more heavily traveled areas. Sand was spread over the tar to prevent it from sticking to wheels. This process was called "tar-bound macadam," which led to the term "tarmac." As more roads were covered with impervious materials, storm drains were installed to prevent road flooding.

The move to asphalt was a major advance. A sticky petroleum product mixed with materials such as sand and gravel, asphalt is now the road surface of choice and is used by the Brattleboro Public Works Department.

Lines for water, sewage, illuminating gas, electricity, and telephones placed still another demand on Brattleboro's roadways, as they became the underground route for these services to reach the citizens. Buried beneath the town's streets, pipes and conduits are accessible at intervals by street-level manholes. When there is a water main break, however, a Public Works crew must dig up the road. After repairing the main, the men fill the ditch and patch the road.

A road can be patched many times, but eventually its integrity becomes compromised, leading to extensive and costly repairs. An interim step before rebuilding the road, however, is resurfacing

(opposite top) Al Franklin, Jr., lifting slab of asphalt.

(opposite bottom) Brion Frechette soon to haul away old asphalt.

with a shim-coat. A thin layer of asphalt is rolled onto the existing road surface to fill in cracks caused by frost and traffic.

When the road is severely deteriorated, it must be rebuilt. This is a major undertaking; it is also an opportunity to address other problems with the road. Additional catch basins connected to storm drains may be installed, the road's pitch changed to correct drainage problems, and parts of the road straightened or widened. Either a backhoe tears up the asphalt, which is hauled away, or a reclaiming machine removes it, grinds it to a uniform size, and spreads it on the road base. After the reclaimed material has been rolled, a new layer of asphalt is applied.

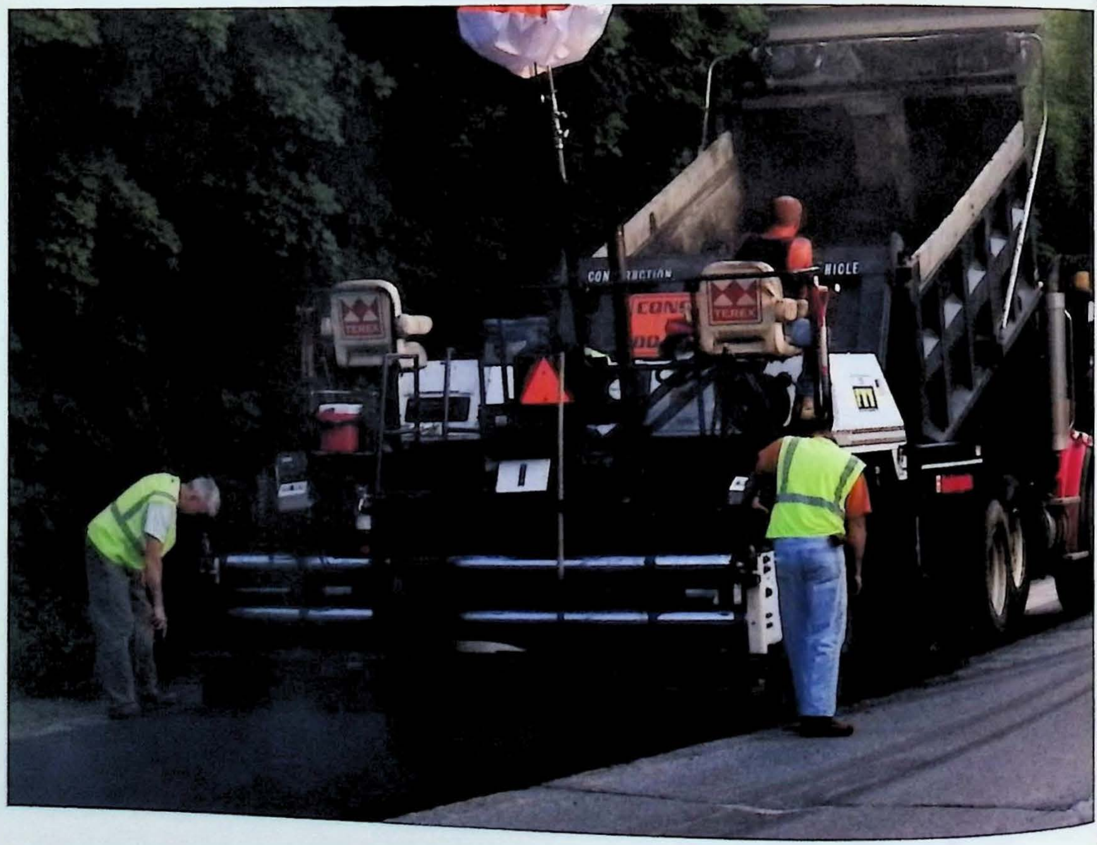
Cold-planing is a variation of reclaiming, except that only a one and one-half inch layer of asphalt is removed and carted away before a new layer is applied. Shim-coating, cold-planing, and rebuilding require considerable planning and coordination. The work can only be done, for example, when the frost has left the

(left) Normand Comptois grading before paving.

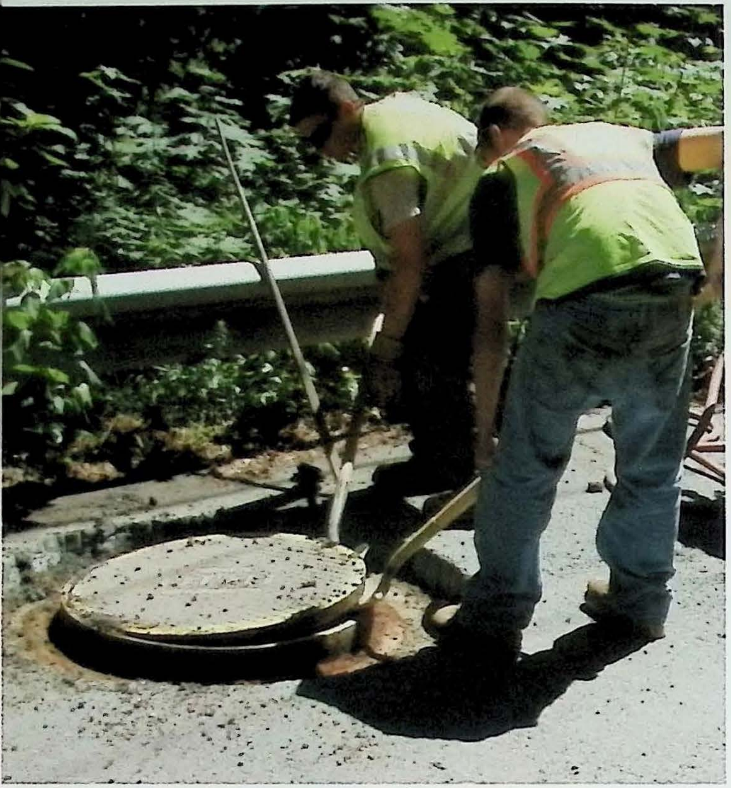
Tom O'Connell, Jr., shows that shovels are still needed.

ground. Since the Public Works Department doesn't own much of the needed equipment or have a large enough staff to complete the job quickly, it must be contracted out to companies who specialize in this work.

These are the broad outlines of what must be done to resurface or rebuild a road. But there are other steps along the way. Proposal



requests describing the job must go to area contractors, and proposals must be evaluated. A traffic control plan must allow passage for emergency vehicles and minimize traffic backup. The Utility Division must raise storm drain grates, water valve covers, and manholes to be flush with the new road surface. And weather forecasts are critical; even a light shower can change the schedule at the last minute because asphalt will not bond to a wet surface. ■



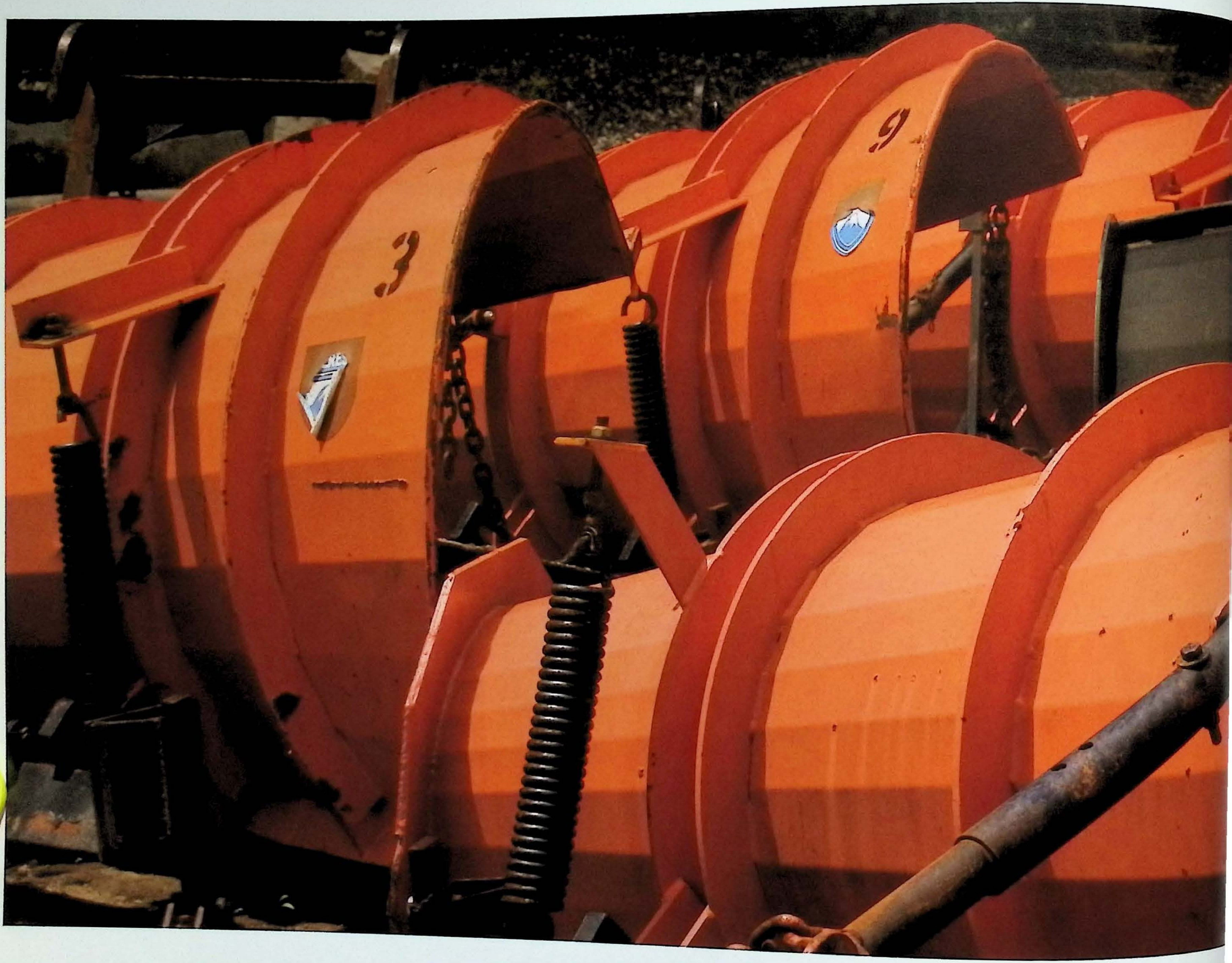
(left) Travis Sanctuary (left) and Devin Bucossi raising manhole cover for new paving.

Ready for paving.

(opposite top) Work requires a fleet of expensive equipment for timely completion.

(opposite bottom left) Contractor employees readying joint for next section.

(opposite bottom right) Applying shim-coat.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SNOW REMOVAL

(above) Freshly painted plows wait for winter.

(opposite) The springs on these plow blades let the bottom edge of the plow absorb road bumps.

In earlier times snow drifts often completely closed a road and prevented travel. One method used to overcome nature's obstacle was to pack down the snow to make the road suitable, not for horse-drawn wagons, but for sleighs. In New England, as in other locations prone to heavy snow, giant rollers pulled by a team of oxen were drawn over the fresh snow to pack it as hard as possible. Former Brattleboro Public Works employee Lester Powers remembers his dad operating a snow roller on Stratton Hill. The work was shared with neighbors, who would roll the road for a few miles and then be relieved by a neighbor with a fresh team of oxen. On wider roads, such as Main Street, a double roller was used. Snow rollers were used in the 19th century and, on some roads, well into the 20th century. Sidewalks were hand-shoveled until the development of the snow blower.

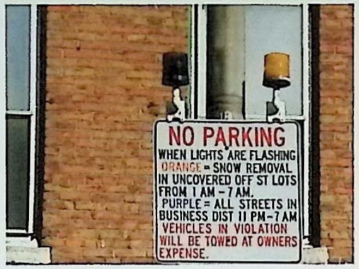
When the railroad and trolley began to replace horse-drawn wagons, the tracks had to be completely cleared of snow. Front-end plows pushed most of the snow away, but men shoveled the switches, to keep them from jamming, as well as parts of the tracks.

With the advent of the automobile in the early 20th century, snowplowing gradually replaced rolling. Automobile tires, unlike wagon wheels, needed traction in order to "grab" the road and propel the car, which the tire's tread could do if both snowfall and traffic were light. Roads smothered in deep snow or made slick by heavy traffic were dangerous. Other techniques came into play, such as spreading sand or salt on slick areas and putting extra weight (often rocks) over the drive wheels of the car. Chains were also used, as they are today, to give the tires greater traction.

Early plows were a simple V shape that moved the snow to each side of the road. Early single-blade plows, set at a forty-five degree angle, pushed the snow just to one side. But after repeated plowings, the road became too narrow to use, a problem with two solutions: more sophisticated plows and snow removal. New plows were developed that could move the snow from the road to one side and then to a higher elevation, forming a shelf of snow at the road's edge without narrowing the road. The plow's "wings" that created the shelf were at first controlled by men using a block and tackle line. Today the wings are controlled hydraulically by the plow's operator.

Sometimes, however, snow piles up and must be removed, especially on narrow roads, business streets, and at intersections.

(left) Contractors are hired to clear and haul away snow in congested areas. The high, straight sides of this plow keep snow from spilling out.



(below) Grader and truck work in tandem on Cedar Street.

(opposite) Front-end loader with plow attached, one of several Public Works vehicles that can be used for different jobs. Narrow winter streets require careful driving.

When this happens the snow is trucked to one of two dump sites, either near Exit 1 off Interstate 91 or off Route 30. This work is often done at night when traffic is light. Additional dump trucks are hired and act as an old-fashioned bucket brigade, circulating between the dump site and the town's giant snow blower, which fills each truck in ten seconds.

Brattleboro, like many other municipalities, has tried various ways to keep the roads clear of snow. It has now developed a system that is meeting the town's needs, given the resources available.

Salt and sand, which can be used separately or as a mixture, is delivered by truck directly to the yard of the Public Works garage, where it is stored. Lester Powers remembers hand-shoveling the salt from a railroad car at Union Station into a wheelbarrow, pushing it up a ramp, and dumping it into a town truck. Powers' job was made easier with the introduction of an auger, powered by a gasoline engine.

When there is a chance of snow, plows, sand/salt spreaders, and tire chains are readied for fast hookup to the town's twelve vehicles. At the first sign of precipitation, strobe light signals in the downtown area are activated, alerting citizens not to park their cars on the street. This system was initiated in Brattleboro after former Police Chief Richard Guthrie saw a similar system in operation in Bennington, Vermont. Depending on the characteristics of the storm and the temperature, the department decides whether to use salt, sand, or a mixture. The trucks are then loaded and head out on their routes. If a light snow is expected and the temperature is right, salt is spread to prevent the

A $1,200 load of salt being delivered at Public Works salt barn. At $54.95 per ton, use must be closely monitored. The barn is one of two buildings remaining from the fairgrounds at this site.

snow from turning to ice and bonding to the road's surface. Salt is not effective if the road surface temperature falls below fifteen degrees.

There are twelve snow removal routes, covering the eighty-four miles of Brattleboro roads. The entire work crew is trained to operate the plows and snow blowers. The department tackles storms in a staged response, clearing school bus and heavily traveled routes first. Other drivers are then called in to plow additional roads. The maintenance crew is on duty to handle breakdowns.

Homeowners are painfully aware of the labor required to shovel their walks. Now the town and many homeowners use snow blowers to clear sidewalks and parking areas. ■

Snow blower with 260 hp Cummins engine can fill a truck in ten seconds.

A $1,200 load of salt being delivered at Public Works salt barn. At $54.95 per ton, use must be closely monitored. The barn is one of two buildings remaining from the fairgrounds at this site.

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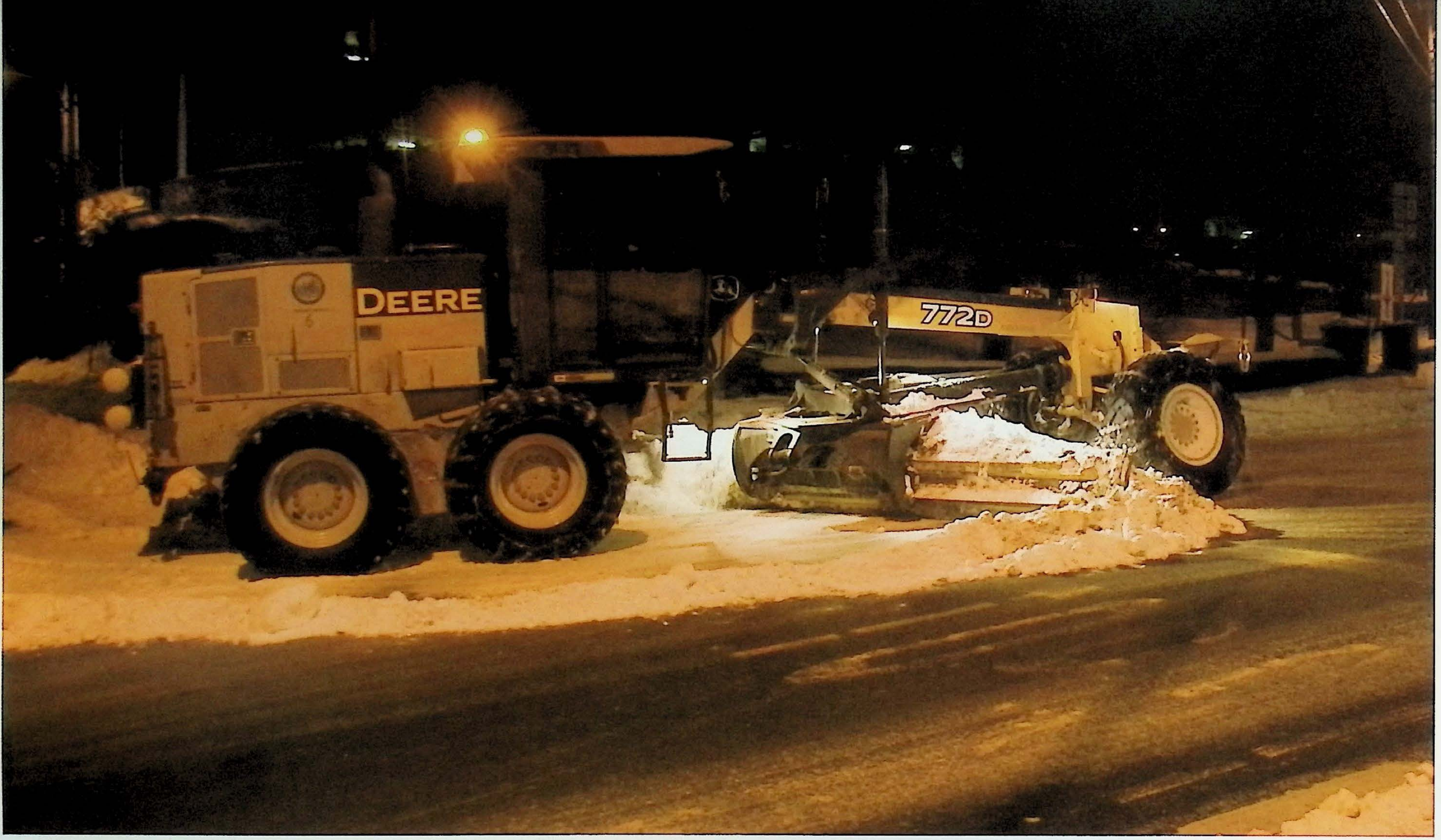


(opposite) All-drive, six-wheel John Deere grader, converted for snow removal by adding a plow.

(opposite bottom) Chains in place; tire treads are not always adequate.

Cleared snow piled off Route 30. As snow melts, road debris picked up during plowing must be hauled to the landfill.

(above) Road grader with plow wing attached. Street markings take a beating when intersections are cleared.

S240

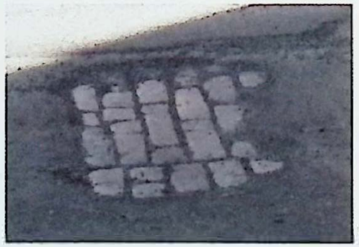
POTHOLES

KERPLUNK went Lynn Corum's car as she bumped over a large pothole. "I think I just blew a tire with that one!" she exclaimed. Unfortunately that's just what she did on March 11, 2008, when she and her husband, Jesse, passed the intersection of Canal and Pine Streets on their way to the Brattleboro Union High School to hear the election returns. Jesse would learn that he had just been elected to the Brattleboro Selectboard. Within an hour's time, he went from being the victim of a pothole to being responsible for its repair.

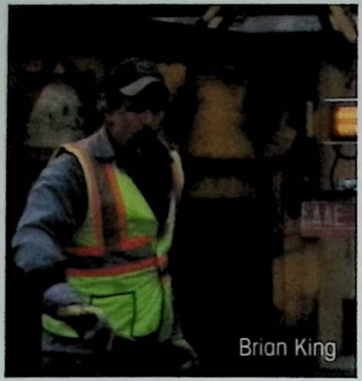
Before paved roads a "pothole" was a smooth-sided hole in a riverbed caused by a whirlpool, the prolonged swirling erosion of

A Brattleboro pothole.

Tire-buster on Park Place.



Fortunately some potholes only get as deep as the cobblestones of many years ago.

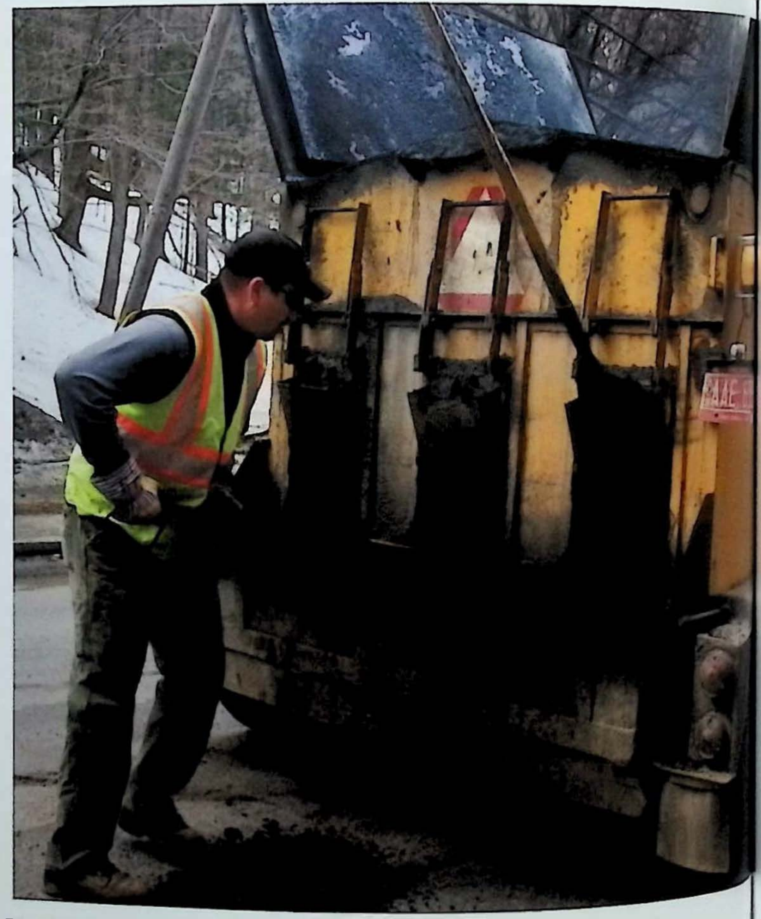


sediment-laden water. The potholes people cuss at today are the by-product of paved roads. As cracks develop in the road's surface, water finds its way through the road's subbase (crushed rock) to the soil below. The moisture accumulates, then freezes and expands, cracking the road's surface. When the ice melts, it contracts and a pothole is born, becoming a road hazard for an unsuspecting motorist, especially when it is disguised as a simple puddle.

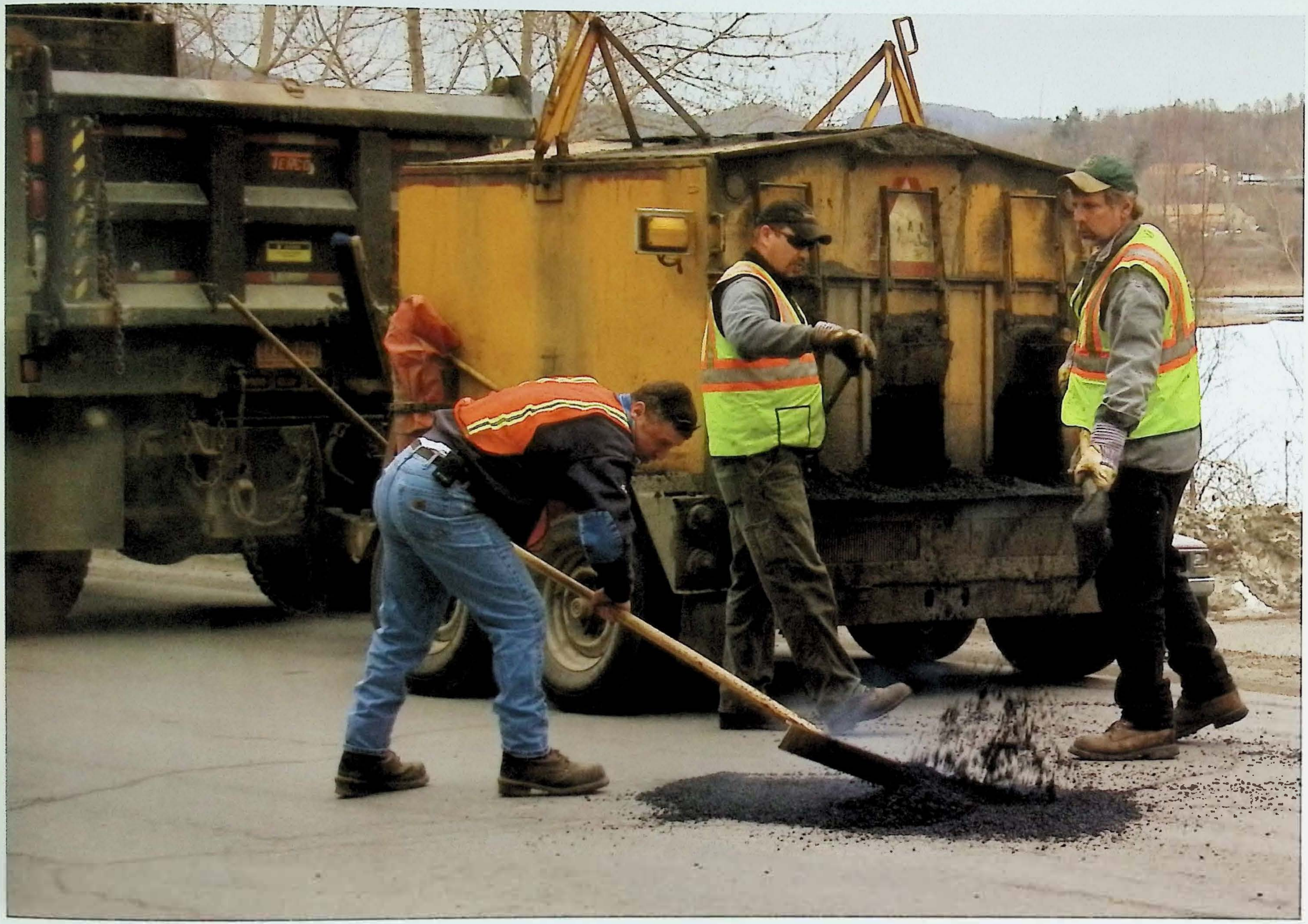
Early spring is pothole season for motorists in the Northeast. As drivers know, potholes pack two charges: one is the jolt to the body and the front end of the car; the other is the emotional jolt to the nervous system — the sudden shock, then the fear that it may have damaged the car. Often the immediate thought is to blame the town for this unavoidable natural phenomenon.

In Brattleboro the 2007–08 pothole season focused its energy on Park Place in front of the Common, eliciting both profanity and humor such as Town Manager Barbara Sondag's quip at Town Meeting. After much discussion about the need for more money to improve Brattleboro's roads, Barbara said, "The potholes we have

At 7:30 A.M. the hotbox leaves the Public Works yard for the Massachusetts asphalt plant.



Frank Howard shovels the 400 degree hot mix from hotbox to pothole.



L-R: Rick Looman, Jr., Frank Howard, Brian King.

Brian King keeps the hot mix moving.

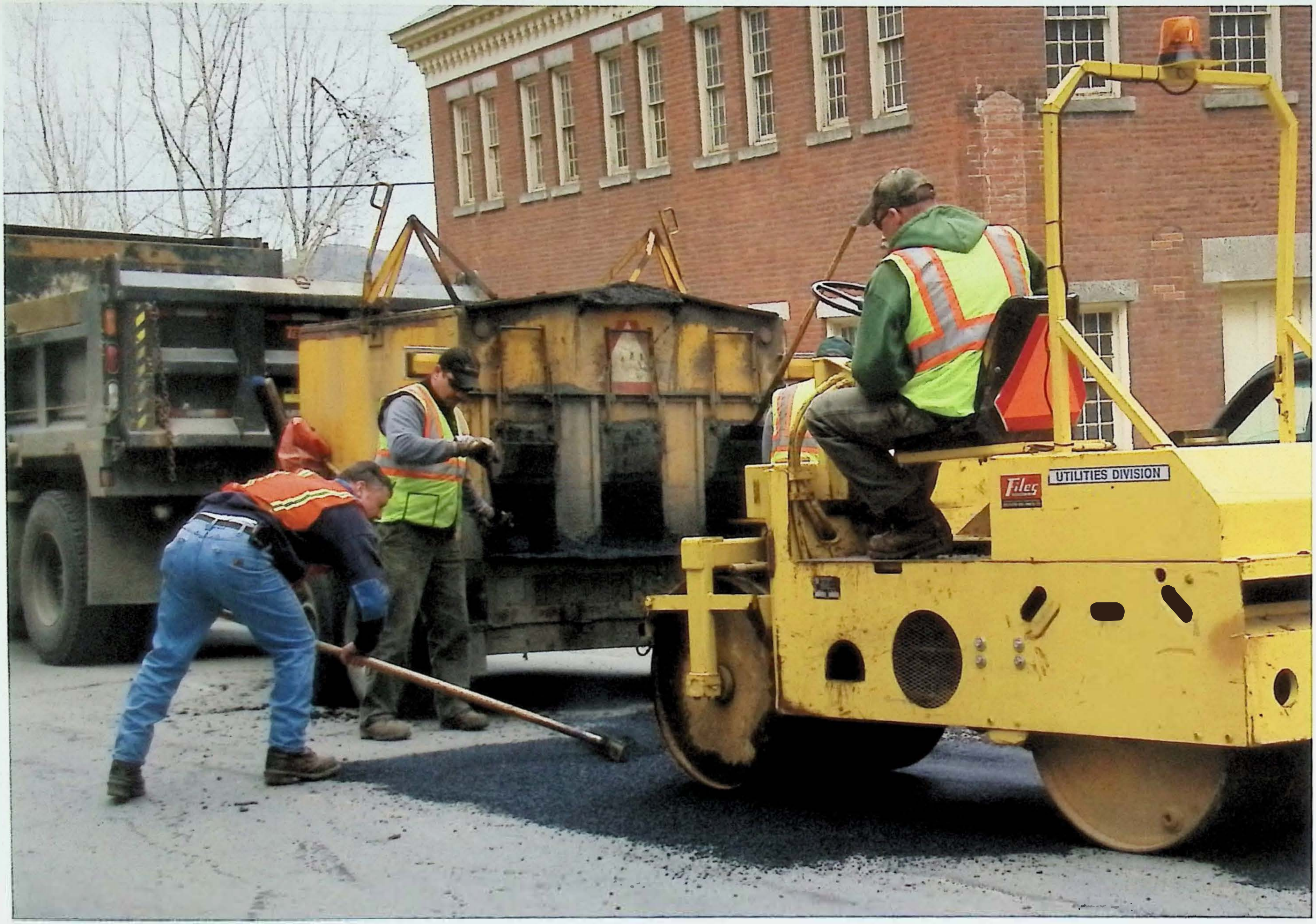
put on Park Place have done a great job of traffic calming, and no one has thanked us for that" (the money was appropriated). For people at the Brattleboro Public Works Department, the humor is grimmer. While they sympathize with drivers who hit potholes, pothole season is a troubled time for the department because of the high volume of complaints, the limited resources for timely repairs, and the short life of interim patching. In early spring when only cold patch is available because asphalt plants close in the winter months, the potholes often form faster than the road crews can fix them. For pothole repair three to four two-man crews work full-time from March to May. Routine work until late fall can be handled by one crew.

L-R: Rick Looman, Jr., Frank Howard, Brian King spreading and smoothing the hot mix.

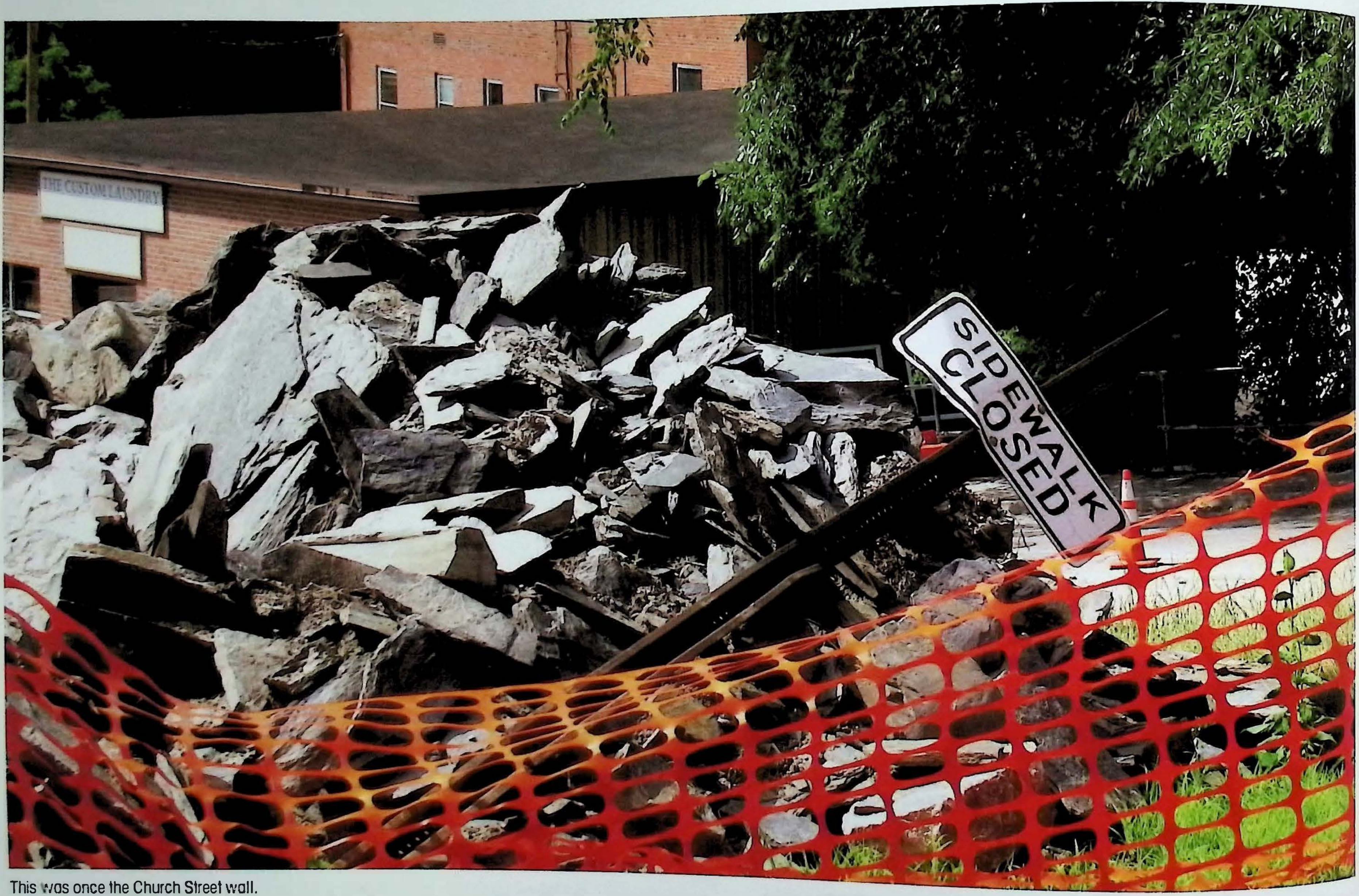
Some paved roads evolved from the pathways of early settlers. Many roads were once dirt. Interstate 91 was designed to be paved, which makes a big difference in the maintenance costs. When a road's subbase is built to allow proper drainage, there is less opportunity for ice to form under the surface. The operative word is "less." Even I-91 gets potholes, but nothing compared to roads such as Park Place.

The Public Works Department uses three methods to repair potholes: cold-mix patching, hot-mix patching, or complete road resurfacing, all using asphalt. Cold mix, the only material available early on, fills the hole, but it doesn't bond well with the surrounding material and is likely to be worn away by passing traffic; therefore, cold mix is used only as a temporary repair. Hot mix is a much better material because of its bonding properties; however, it is more expensive and must be maintained at 350 to 400 degrees. To keep the material hot, Public Works purchased an asphalt hotbox reclaimer in 1998 that uses propane-fired heaters to keep three tons of hot mix at the proper temperature. A town truck tows the hotbox first to the asphalt plant in Massachusetts for loading and then to the repair sites. The hotbox keeps the material at the proper temperature for use during the day and the next day, too, if some is left over, which is why the machine is called a reclaimer. Prior to the use of the hotbox, workers had only a brief time to use the asphalt before it hardened.

The repair of a pothole may be likened to a dentist filling a cavity in a tooth. In the most thorough pothole repair, the damaged area, including the subbase, is cleaned out until the edges are free of the decayed material and a firm base has been reached. The hole is then filled with hot mix and compacted and smoothed to the road surface with a heavy, self-propelled roller. ■



L-R: Rick Looman, Jr., Frank Howard, and Matt Ogden — last spreading and final rolling.



This was once the Church Street wall.

RETAINING WALLS

Brattleboro's hilly topography contributed to the town's development by providing water power for mills and factories but also presented obstacles. Because there are few flat areas in Brattleboro, retaining walls had to be used to hold back hillsides before a road or building site could be created. Over time, erosion, frost, and gravity caused many of these early walls to fail. A striking example of a recent failure, now a success story, is the Church Street wall, which collapsed in March 2007.

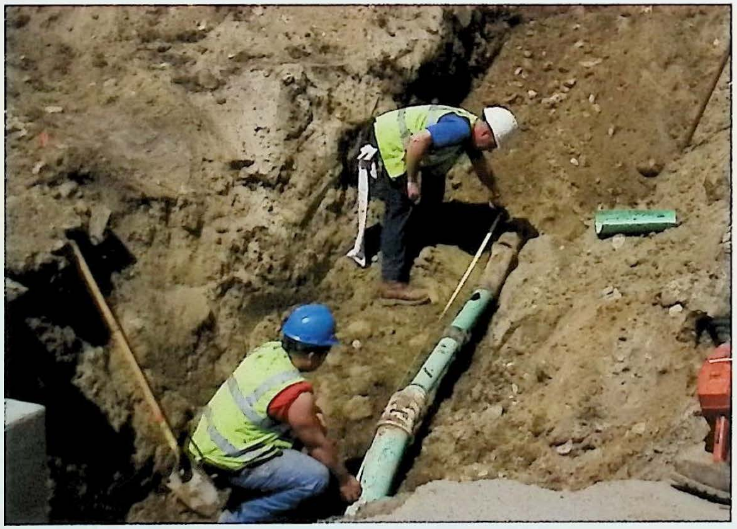
Each morning Steve Barrett, Director of the Public Works Department, passes the wall on his way to work. Some time ago he began to notice telltale signs of failure. First the wall shifted out of plumb; later it began to bulge. Barrett then closed the sidewalk for safety reasons, months before the retaining wall spilled onto the sidewalk.

In the past because there was no standard for their construction, many walls were built in such a way as almost to guarantee failure, especially if the soil didn't drain well. Without proper drainage water can become trapped behind the wall. In cold weather frost pushes the wall out and may eventually bring it down.

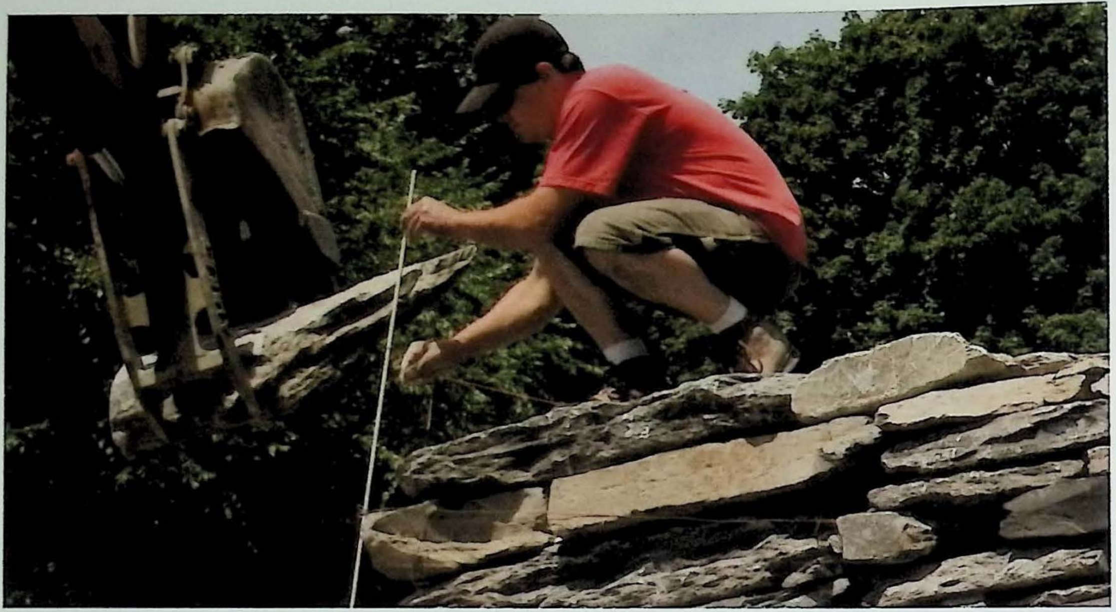
Change of use can also cause problems. The Church Street wall was built before the automobile. The soil, which once drained well, became compacted by automobiles and heavy trucks on the top area behind the wall. Eventually drainage was no longer adequate, and the wall started to give way.

Today the department's Gary King is photographing and recording information about Brattleboro's many retaining walls in an attempt to foresee potential failures.

L-R: Peter Welch workers Krishna Maples and Tyler Maas fine-tune stones for proper fit.


Skip Fletcher at top and Gary Seymour measure for replacement pipe.

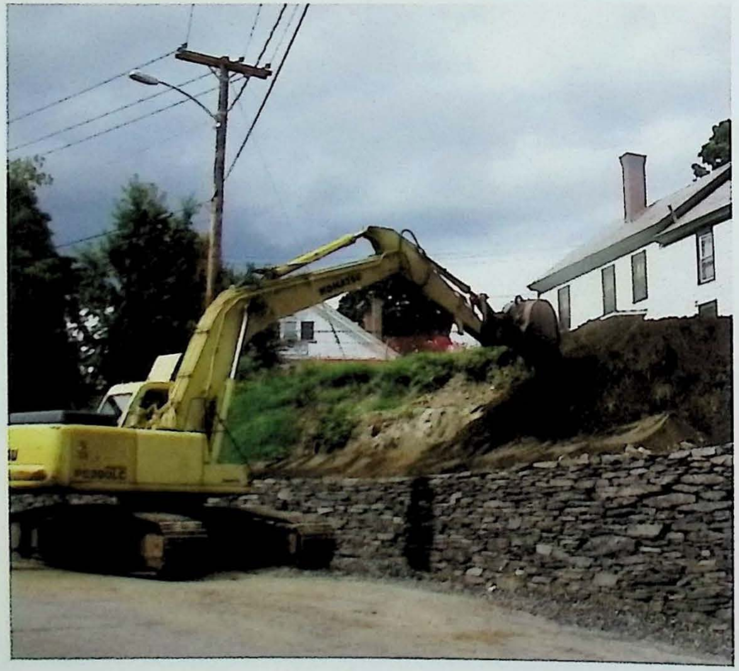
Brian Frechette checks height.



Peter Welch worker Tyler Maas lays stone at proper angle.

Skip Fletcher prepares pipe for fitting.

Go to Kipling's Restaurant & Pub to see Paul Emory's painting.



Stone work done; backfilling in process.

The Public Works Department is responsible for the walls owned by the town, but sometimes ownership is uncertain. A handsome wall may be a private owner's pride — until it collapses. Repair is expensive. Often property deeds and surveys have to be searched to determine a property's boundaries. Such was the case with Church Street. Deeds going back to 1834 were examined but yielded no clear answer. Instead of fighting over it in court, the property owner and the town set upon a joint venture to repair the wall.

Brattleboro's funding for such projects is limited. What was once a stone wall had become a stone pile, and while the stone had value, it would cost money to remove it. Barrett and Town Manager Barbara Sondag decided to explore the possibility of restoring the wall, using the original stone and adding improvements such as drainage and landscaping. Requests for construction proposals were issued. A response from Peter McNeary Welch, a local stonemason who had partnered with Zaluzny Excavating, caught the interest of Barrett and Sondag because his design would use the original stone and do so at a reasonable price. At its meeting of November 2007, the Selectboard enthusiastically approved the proposal, which was accepted at Town Meeting in March 2008.

"My interest in the project was twofold," said Welch. "First, it was a great opportunity to demonstrate how, by using native stone and time-honored masonry skills, attractive walls can be built at reasonable costs. And, secondly, it was a good place to showcase my work."

The showcasing included publicity that Welch could not have anticipated. Artist Paul Emory of Gainesville, Ohio, set up his easel and captured on canvas the new wall under construction. The painting hangs at Kipling's Restaurant & Pub (formerly Mike's) on Elliot Street, where it is on display.

During the Church Street work, some forgotten history was uncovered that led to a change in thinking how best to restore the wall. Barrett remembered that, as a youngster, he played in a park at the top of the wall, which had a sign bearing the name Brosnahan. After a little research and the help of Mary Lou Buchanan, a volunteer at the Brooks Memorial Library History Room, Barrett learned that in 1934 the park was dedicated to John Francis Brosnahan, a Brattleboro resident who in 1918 was killed in action in WWI. The park and the marker had long since disappeared and attracted little attention until the wall's collapse.

With the professional guidance of Martin Webster, a local landscaper, and with the input of local citizens, the park will also be restored. After word went out that Barrett was trying to locate the old plaque, one morning it appeared on his desk. It, too, has been restored and added to the park.

Webster selected native plants that offer spring flowering and bright fall color. The plantings will also stabilize the bank and provide attractive ground cover, eliminating the need for mowing. Webster said that "Landscaping generally gets short consideration in municipal projects, coming at the end when there are few resources left for things like trees and shrubs. So it was nice to hear that Steve wanted suggestions for planting the area."

The Public Works Department contributed much, coordinating and supervising the whole project and installing the sidewalk and storm drains.

As the photos depict, Brattleboro has a variety of retaining walls. These walls are easily seen as one walks or drives around town. Some are much more attractive than others. In the ranks of those that are not only functional but a pleasure to look at, the Church Street wall may well take first place. ■

A metal wall tackles Brattleboro's hilly topography.

Frost at work.

A home-grown wall in its last stages.

Vernon Street wall built by the railroad in early 20th century.

Dual role: hillside support and artist's canvas.

The pride of ownership.

WINDHAM COUNTY, VERMONT
HIGHWAY DIVISION
6
WIX
533776

MAINTENANCE

Roads, water lines, and sewer lines depend for their upkeep on the heavy machinery of the Public Works Department. The treatment of water and waste adds more delicate equipment. Both kinds are complex, requiring expert attention to be kept in good repair. At times of great demand, such as snowstorms, breakdowns can cause major problems, and malfunctions at either the fresh or wastewater plant can be very disruptive.

(left) Scott Blodgett.

(below) Scott Blodgett (left) and Bill Buedinger.

(above) Bill Buedinger (back to camera) and Scott Blodgett making major repairs on dump truck's rear springs, brake shoes, and axle seal.

(right) Bill Buedinger (foreground) and Scott Blodgett using torque wrench to tighten nut that holds wheel bearing in place. Torque is a twisting or turning motion. A torque wrench can be set to allow just the right degree of tightness.

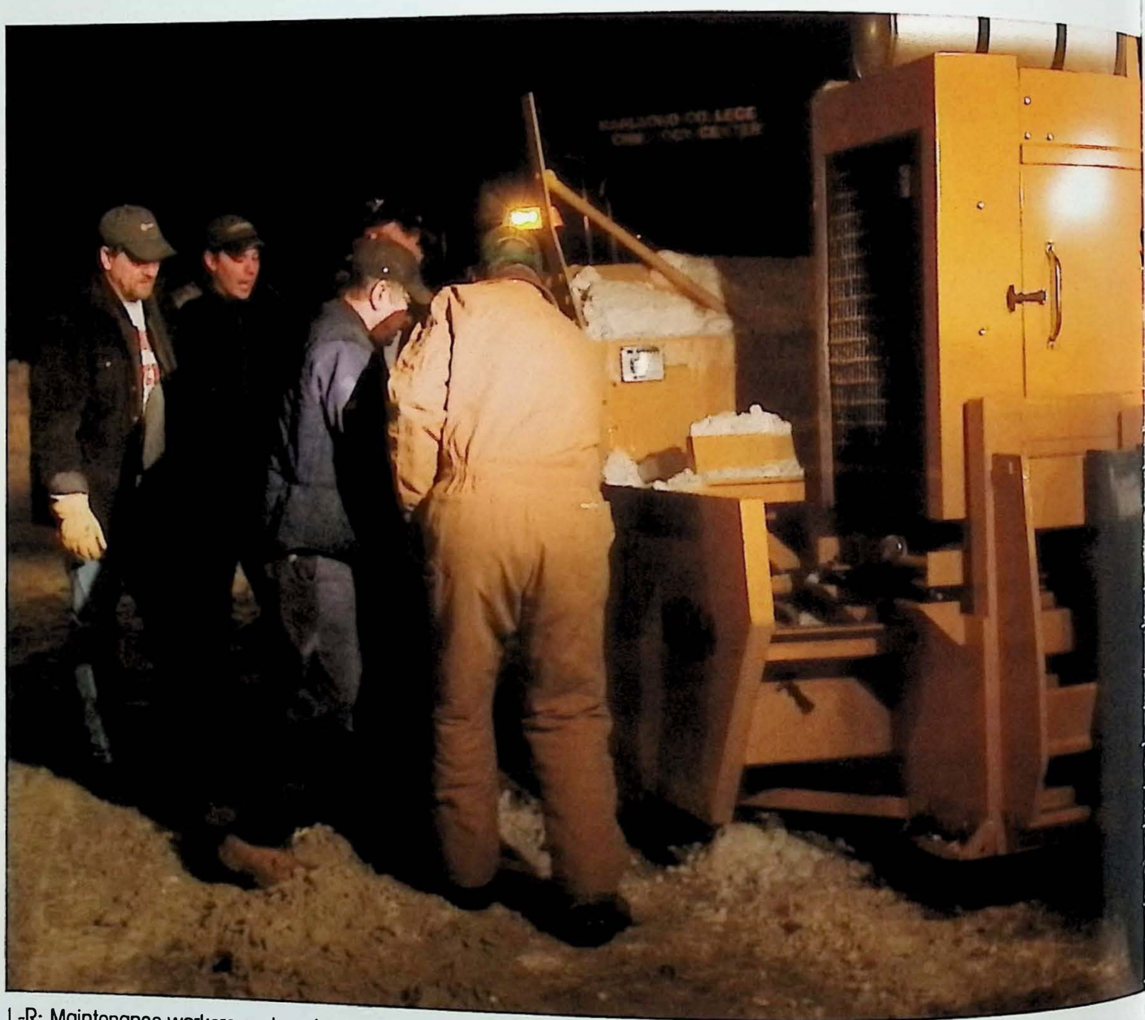
(opposite) Bill Buedinger (left) and Scott Blodgett search for oil leak in hydraulic system of John Deere grader.

(right) Charlie Kent installing a truck's rear spring assembly.

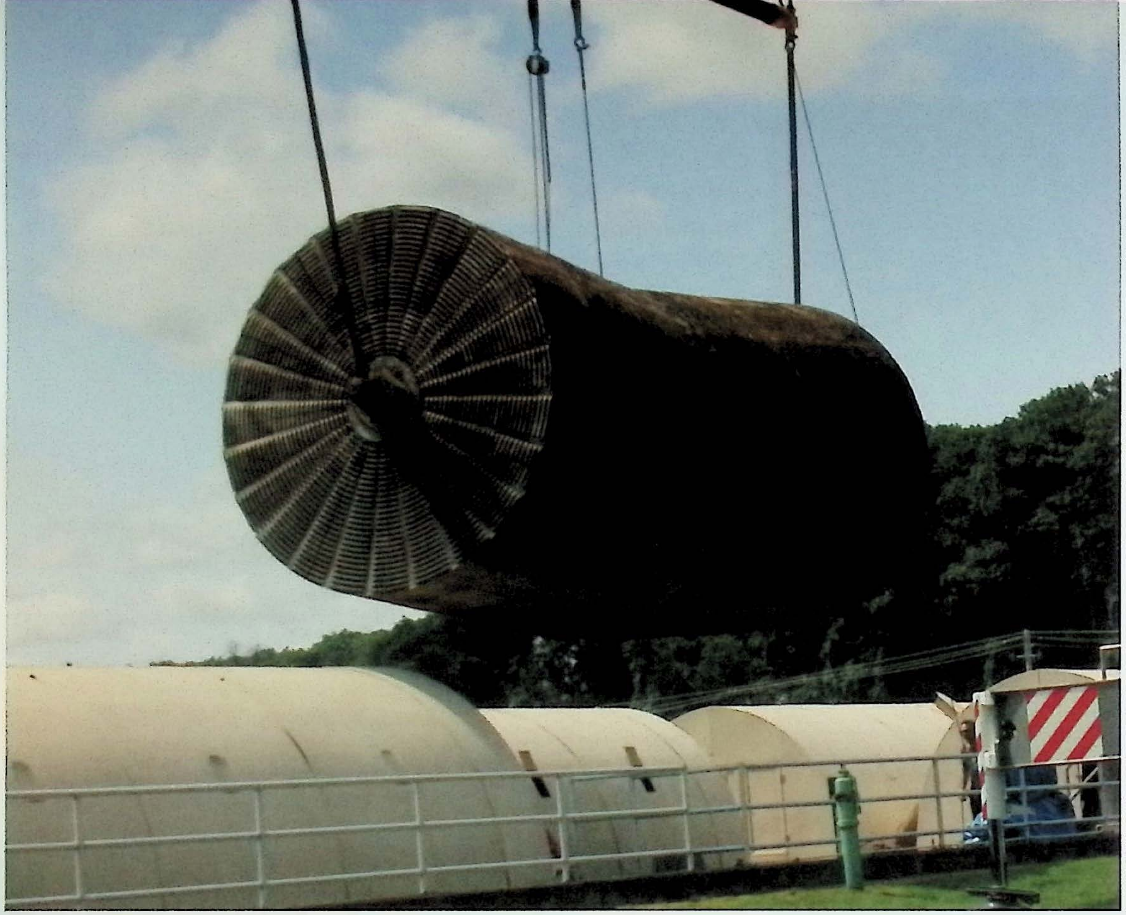
Frank Howard repairing corrosion damage to electrical contact pins on one of the dump trucks. Corrosion prevented the engine from starting and caused the rear brakes to malfunction.

Bill Buedinger pressure washing sidewalk tractor while Charlie Kent, in cab, rotates the the snow shoot to expose all parts. Second sidewalk tractor in background.

Oil changes, brake work, wheel bearing replacement, rust prevention — all these and more are part of the department's year-round maintenance program. With employees trained in truck maintenance and welding, most of this work is done at the town garage. Sometimes, however, it is necessary to make repairs on site. In the mud season of March 2009, for example, a town grader burst a hose on Bonnyvale Road. The grader crew radioed

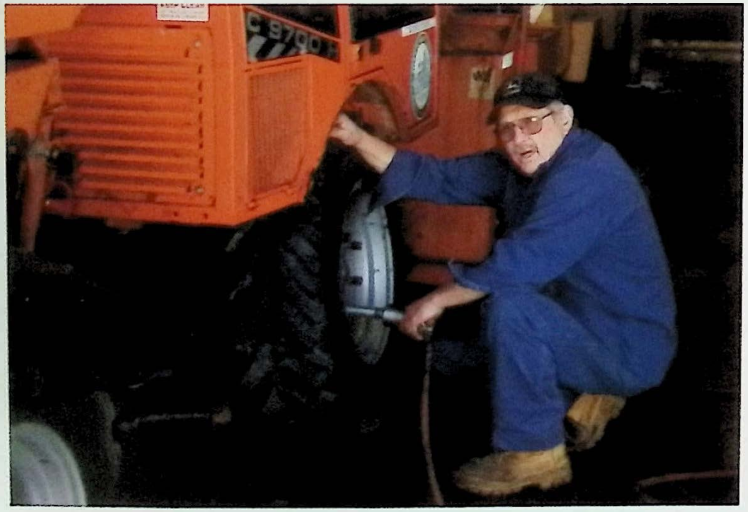


L-R: Maintenance workers and equipment operators Don Grant, Scott Fowler, Al Franklin, Jr., Charlie Kent, and Brian King replacing broken shear bolts on snow blower during lower Main Street snow removal. Removal started at 11:00 P.M. when traffic was light.



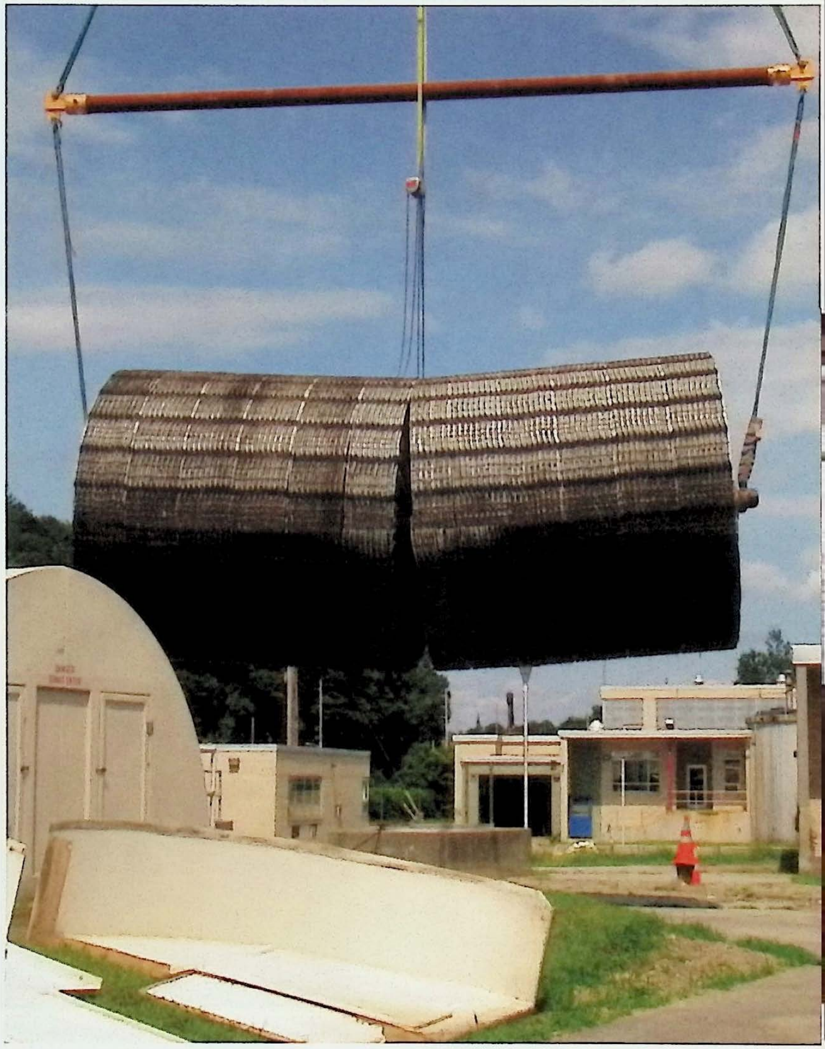
specifications to the garage, where Bill Buedinger fabricated a new hose, then took it to Bonnyvale Road to install it. On-site repairs happen often in the winter when snow blower shear bolts break.

In some instances specialized workers and equipment may be brought in from the community. Outside technicians may be needed to correct problems at the treatment plants. A dramatic



(above) Crane operated by Renaud Brothers lifting contactor from cover for repair of broken axle.

(left) Charlie Kent cleaning sidewalk tractor after winter's use.



(right) Split shows where axle is broken.

Sections of contactor after they have been removed from axle.

use of outside help was the repair in August 2008 of a broken axle in one of the twenty rotating biological contactors at the wastewater plant (see "Wastewater Treatment"). The Renaud Brothers, a local general contractor, lifted the contactor from the tank, disassembled it, welded the axle, and replaced the contactor, all on site and in twenty days, a collaboration good for both the department and the wider community.

Other efforts reach beyond technical needs. The high school's Community Based Learning Program puts students to work part-time at the department for the hands-on experience that may also develop academic skills. Mentored by Public Works employees, the students often re-engage with the academic program and learn skills that make them possible candidates for summer jobs at Public Works or even full-time employees on graduation. Faculty member Lisa Johnson runs the program. The most recent student was Blake Pierce who worked in Maintenance under the supervision of Scott Blodgett. ■

Pulling broken axle from contactor.

Contactor photos by Neal Tozier.

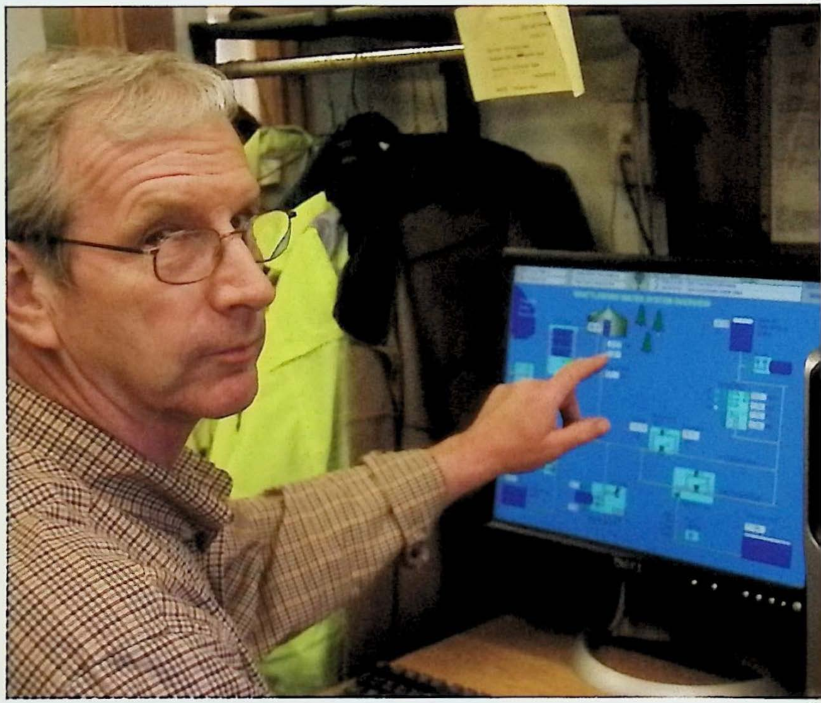
Charlie Kent (left) and Blake Pierce.

Reinstalling contactor section on repaired axle.

TOOLS OF THE TRADE

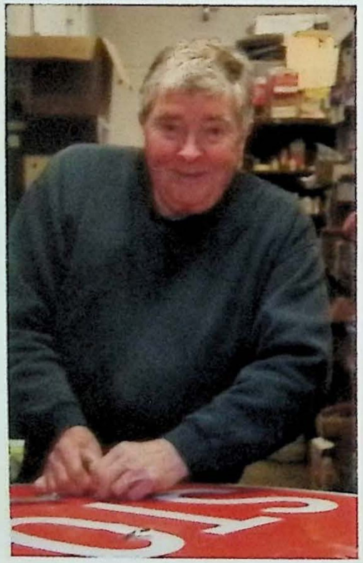
Broadly speaking, a tool is any device that performs or assists in work. Schoolroom physics told us about the lever, pulley, wheel, hammer, and inclined plane. Such simple tools increase the force of human muscle. Other tools, especially optical and electronic ones, extend the range of the senses or sharpen them, enabling us to see or hear what would otherwise escape our notice.

Machines are complex tools or arrangements of tools, which multiply human powers many times over. One could write an entire book about the many tools and machines used by Public Works. Here is a small sample. ■

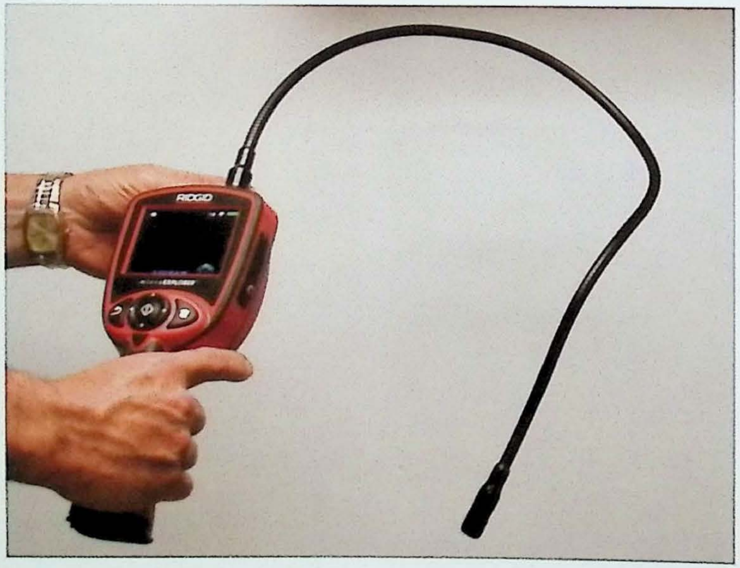


Rick Ethier. The computer is now an essential management tool.

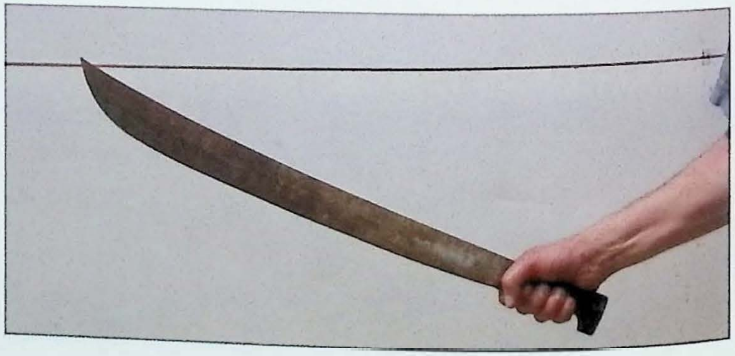
Gory King with measuring wheel that indicates distances as it's rolled along.

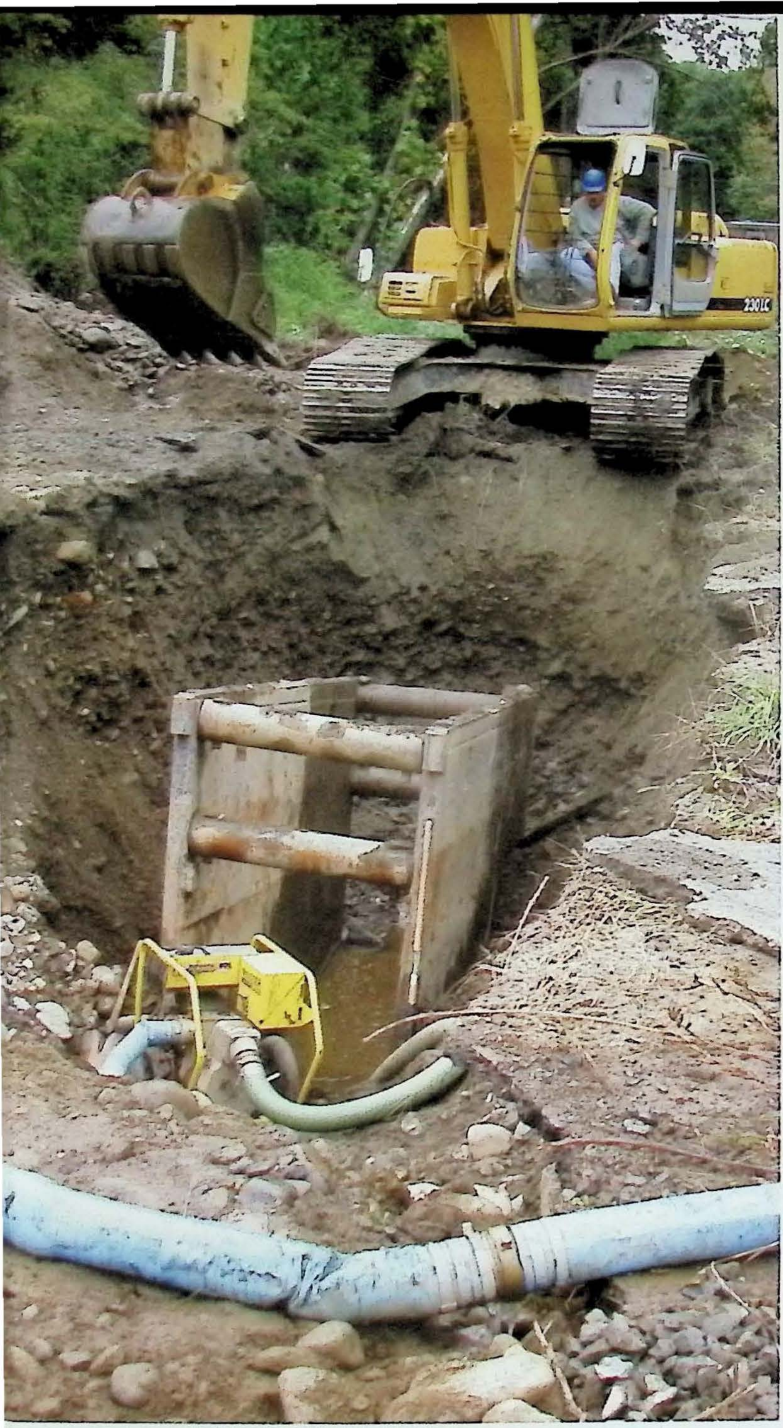


Elliot L. Georgina, Sr., working on sign.

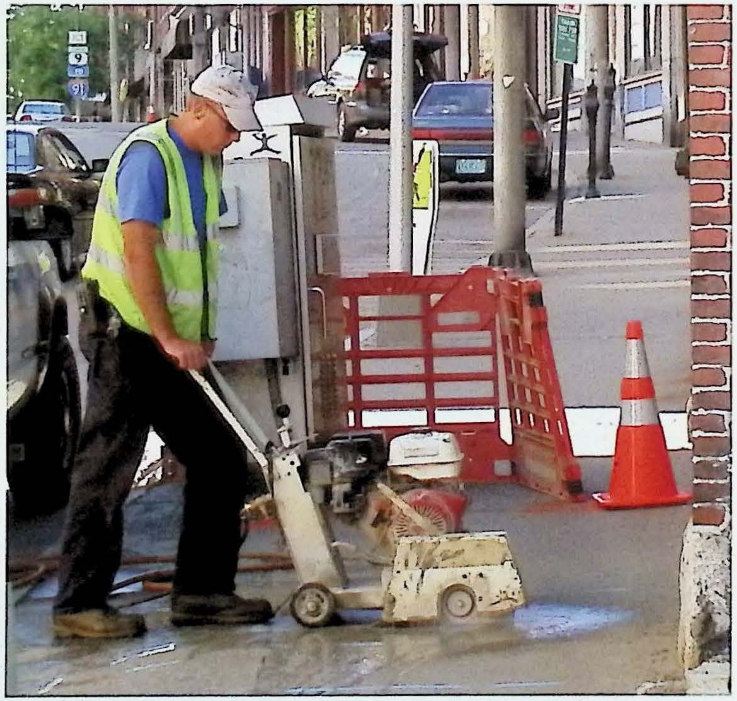


Fiber optics enable this camera to find problems without hit-or-miss excavation.





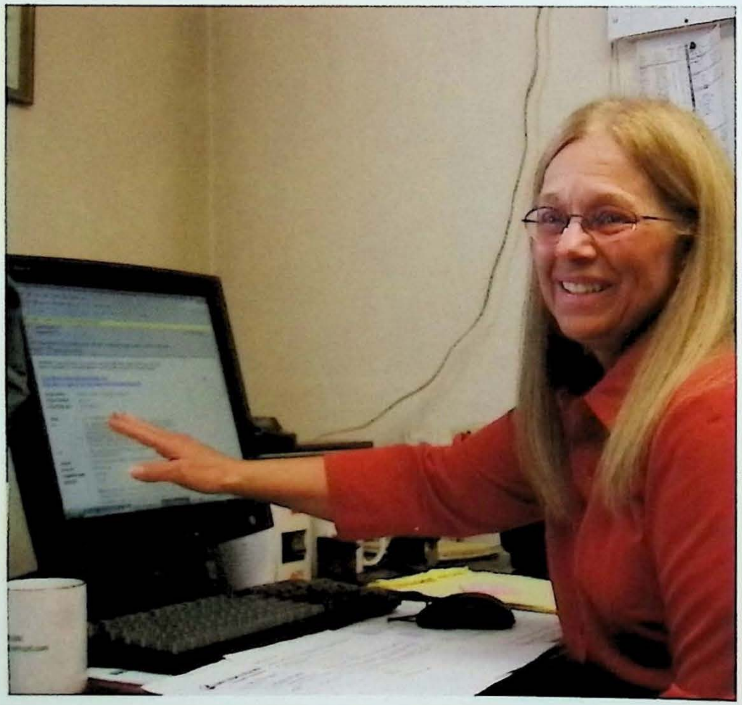
Ditch box prevents cave-ins; pump removes water.



Brett Grout cutting pavement.

Bolt cutters, come-along, and ditch box chains.

Impactor breaks up pavement.



(left) Cheryl Petrin's office is the clearing house and communication center of Public Works. Among her duties is keeping track of time sheets, purchase orders, project reports, mail, and the whereabouts of workers on the job.

ABOUT THE AUTHORS

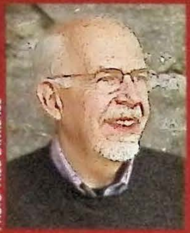


PHOTO FRED LAWRENCE

Wayne Carhart is a retired health administrator from Manhattan and a former President of the Brattleboro Historical Society. He recently published *Brattleboro: Pages in Time* to commemorate the hundredth anniversary of The Brattleboro Area Chamber of Commerce.

PHOTO CARL MCINERNEY

Charles Fish is a Vermont native and retired college professor. His most recent book is *In the Land of the Wild Onion: Travels Along Vermont's Winooski River.*

All proceeds after design and production costs will go to a special Public Works fund for work-related items. The authors have volunteered their services.

BRATTLEBORO PUBLIC WORKS EMPLOYEES

Steve Barrett
Scott Blodgett
Art Boudreau
Devin Bucossi (summer employee)
Bill Buedinger
Normand Comptois (retired employee)
Gary Corey
Jim DeAngelis
Harvey Dix
Steve Dyer
Rick Ethier
Steve Ferris
Brian Filgate
Skip Fletcher
Scott "Scooter" Fowler
Al Franklin, Jr.
Brian Frechette
Vito Furnari
Elliot L. Georgina, Sr.
Rick "Gramps" Gilbeau
Dan Grant (former employee)
Brett Grout
John Highter
Frank Howard
Charlie Kent
Brian King
Gary King
Rick Looman, Jr.
Jamie McAuliffe
Bob Murray
Tom O'Connell, Jr.
Matt Ogden
Blake Pierce (student intern)
Cheryl Petrin
Stephen Reynolds
Don Rosinski
Travis Sanctuary
Fran Timney
Neal Tozier
Rudy Urgiel

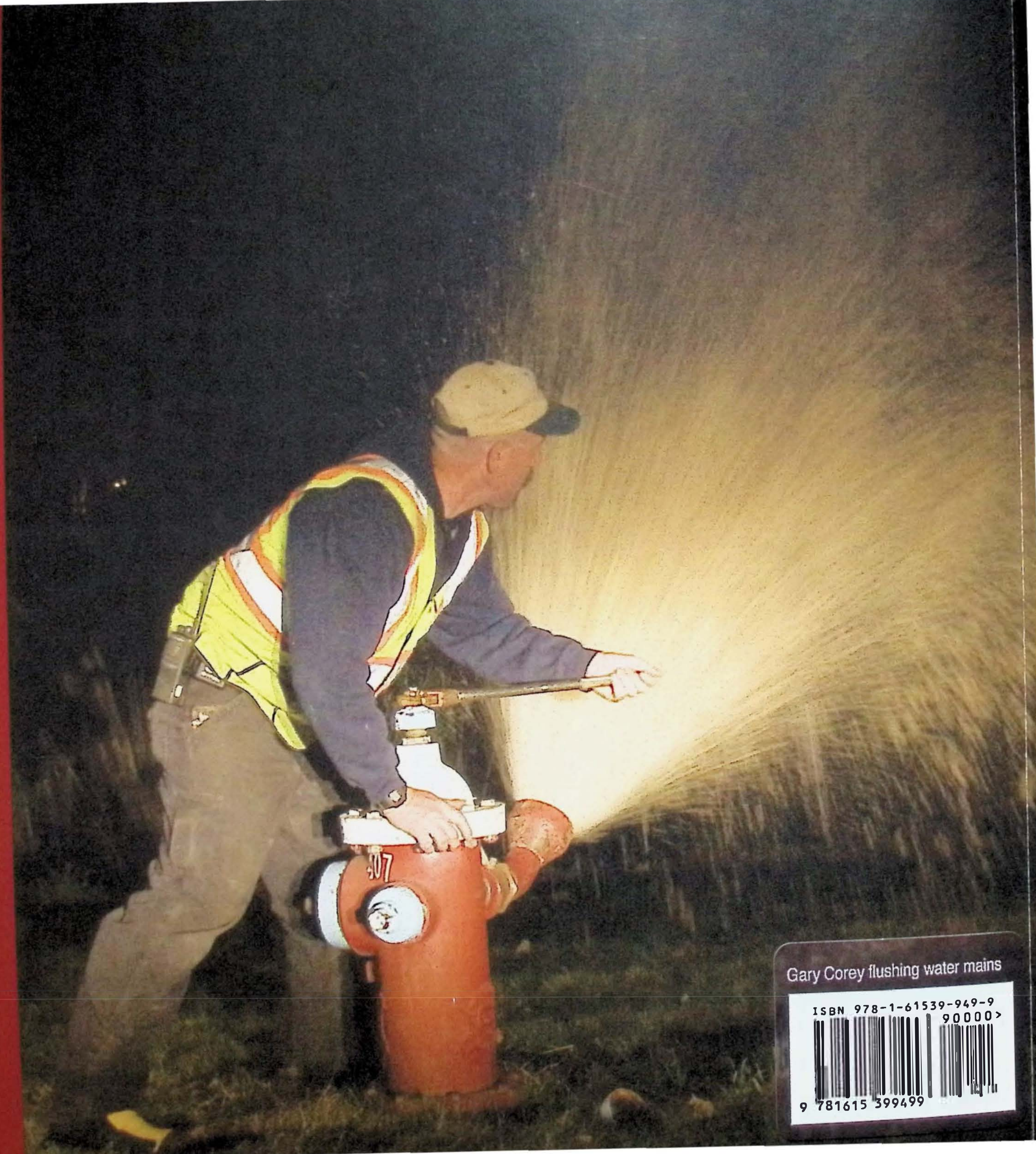
Aldo Leopold said that the dangers of modern life included "supposing that breakfast comes from the grocery, and . . . that heat comes from the furnace." Some other dangers might be thinking that clean water simply flows from the tap; or that dirty water somehow just goes away; or that our roads would magically survive the elements without constant care. This is an interesting peek into the history and day-to-day workings of Public Works.

James Matteau
Executive Director
Windham Regional Commission

Wayne Carhart and Charles Fish have produced for the residents of Brattleboro a highly enjoyable and authoritative book that combines history, engineering, and science. Readers who have reflected on the prodigious amount of complex and demanding work needed to keep Brattleboro functioning as a modern community will find their ideas confirmed by ON THE JOB. Readers who have not reflected along those lines will learn to do so.

Castle Freeman
Novelist and Essayist

Front cover: Skip Fletcher's boots
Front flap: Gary King's hands



Gary Corey flushing water mains

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